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The purposes of this study were to establish an Indoor putting test for beginning golf students; to develop an indoor putting green which could be used in measuring putting accuracy; to study the reliability and validity of the Indoor putting test; and to establish the reliability and validity of an Outdoor putting test used by golf instructors at The University of North Carolina at Greensboro.

One hundred and seventy-one subjects, who were beginning golfers enrolled in ten sections taught by golf instructors that were members of the Department of Health, Physical Education and Recreation during the spring of 1970, participated in this study.

An Indoor green was designed, constructed from styrofoam, and covered with an outdoor-indoor carpet. The twelve feet by fifteen feet green was measured, marked and cut for five regulation holes.

The Indoor putting test was developed. One administration consisted of putting and scoring one ball on the five-hole indoor green. Four administrations, or twenty holes, were requested.

One administration of the Outdoor putting test consisted of putting and scoring nine holes on an outdoor practice green. Two or more administrations were requested.

Game play putts were recorded during regular game play over a period of four to six weeks. Indoor and Outdoor scores were recorded during a two-week testing period.

Calculations to establish reliability involved the actual putting scores for each of the three situations: Indoor test, Outdoor test and game play. Calculations to establish validity were based on ratios derived by dividing the number of putting strokes by the number of holes played. The reliability and validity of the Indoor and Outdoor tests were computed using the Pearson product-moment coefficient of correlation.

The Indoor putting test revealed reliability coefficients of .23 when the first and second trials were correlated; .74 when the best of four trials was correlated with second best of four trials; and .29 when trials three and four were correlated with trials one and two.

Outdoor putting test reliability coefficients were .24 on the first trial versus the second trial, and .69 when the best trial was correlated with the second best trial.

Correlation of the Indoor putting ratios with playing score ratios produced a validity coefficient of .26. The Outdoor putting score ratios correlated with playing score ratios at .26 also. A validity coefficient of .32 was obtained from putting ratios on the Indoor and Outdoor putting test.

Each of the reliability and validity coefficients of the Outdoor and Indoor putting tests represented unacceptable correlations on the basis of statistical evidence.

# THE DEVELOPMENT OF AN INDOOR PUTTING TEST

by

Edna Wolfe Williford

A Thesis Submitted to
the Faculty of the Graduate School at
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Approved by

Rosemary McGee
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APPROVAL SHEET

This thesis has been approved by the following committee of the Faculty of the Graduate School at The University of North Carolina at Greensboro.

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# CHAPTER I

## INTRODUCTION

Golf is taught in an increasing number of physical education programs throughout the country. Since testing can help make teaching more effective, it is desirable to have adequate skills tests in golf to measure the performance of students. Indoor golf classes are conducted in many schools when weather conditions or facilities make the teaching of outdoor classes impossible. Consequently, it is necessary to measure and evaluate student performance of fundamental skills in an indoor situation. As an observer of the teaching and evaluation of golf skills, the writer realized that, essentially, this was being done empirically. Empirical judgment can evaluate form and predict performance but it cannot measure accuracy of performance.

Accuracy is of prime importance in golf; particularly is it important to putting. Therefore, the writer became interested in developing an indoor putting green and using it to find the relationship between performance scores made on outdoor greens and those made on an indoor green.

# CHAPTER II

## STATEMENT OF THE PROBLEM

The purpose of this study was to establish an indoor putting test for beginning golf students at The University of North Carolina at Greensboro.

It was necessary to develop an indoor putting green to test for accuracy in putting. The validity and reliability of the indoor putting test was studied.

The hypothesis of this study was that there would be a high relationship between the scores made by the subjects on an indoor putting test for accuracy and their scores on either an outdoor putting test for accuracy or on their putting scores from actual game play.

# CHAPTER III

## REVIEW OF LITERATURE

The abundance of material now available about golf has been written by professional players, sports writers and educators. From each of these sources comes pleasurable and factual readings that aid teachers, players and spectators in the understanding and learning of this sport. These writings, undoubtedly, have helped and influenced many of the twenty million golfers playing in the United States today. (43)

The professional golfer has written of his own experiences. These experiences he has found successful for his competitor, students and himself. Through his writings, he has willingly and eagerly shared the knowledge he has learned by hard work, trial and error, and through the love and devotion he has given this game. (5, 14, 16, 19, 27)

Sports writers have contributed their talents by presenting colorful stories of the professional golfer as he has encountered failure, tragedy or success. They have kept the public well informed of tournament events, experimental surfaces being used and courses of interest. In general, they have done an excellent job providing teachers, players and spectators with information on the local and national events in golf. (44, 45, 52, 54)

The golf instructor, or educator, has presented material based on experience coupled with findings in research. These writers are concerned with methods, basic scientific and mechanical principles, and with the psychological and physiological patterns evidenced by the learner in acquiring and performing golf skills. (6, 9, 10, 19)

General Golf Studies

Research investigations are reported on techniques, aids and procedure. Others have made attempts to measure golf ability and to relate golf ability to tests of motor ability, kinesthesis, coordination and cardiovascular conditions of golfers in performance. (9, 37, 48, 49, 56, 62, 63) Some of these studies warrant a short review because of their direct relationship with the total game of golf and the indirect relationship they have to putting. The relationship of putting to other strokes is ". . . the fact that the same stroke is used as in any other shot, except that it is done on the most precise scale." (47:26)

A study of the golf-o-tron was done by Chui (32) in 1965. The purpose was to investigate the effectiveness of this mechanical device as a teaching aid and to compare the effectiveness with the conventional practice range method in relation to skill improvement. The second purpose was to investigate the possible transfer effect of skills acquired in the use of the seven-iron to the use of the four-iron. Chui instructed eighty-five college freshmen in the use of the seven-iron. Pre-test and post test

scores were used to determine the effectiveness of the two methods. He found significant improvement in skill with the seven-iron, but no significant difference in the use of one method over the other method. Improvement in skill in the use of the four-iron indicated a positive transfer from use with the seven-iron.

The golf-lite was used by Mathews and McDaniel (37) in 1961 to determine its effectiveness in learning the golf swing. Sixty-six freshmen and sophomore male college students were used in this experiment; thirty-three were placed in the experimental group and thirty-three in the control group. They were taught the same method of swinging and each was required to practice the same amount of time. Each group was given a golf skill test before and after the nine-week instruction period. The experimental group, those using the golf-lite, did appear to benefit from the use of it. The limitations cited in the experimental design made it difficult to credit all improvement to the golf-lite. They were that (a) the experimental group seemed more interested than the control group; (b) the instruction took place in different areas: the control group outside and the experimental group indoors; and (c) the weight of the golf-lite added several ounces to the weight of the club-head.

A mechanical device for stabilizing the head position during the golf swing was used by Ryan (61) in 1964. Thirty-four beginning golf students, all of them women, were used as subjects. The experimental group used the head stabilizer. At

the end of the third, fifth and eighth weeks, motion pictures were taken and rated by three judges. Intercorrelations of the judges' ratings were computed. Ryan concluded that the head stabilizer would be of greater benefit if used in the early stages of learning the golf swing.

Smith (62), in 1968, studied the effectiveness of video tape in learning the pitch and run shot in golf. Thirty-seven undergraduate college women students enrolled in beginning golf classes were tested to ascertain golfing ability in executing a pitch and run shot. Four groups meeting four periods were given fifty minutes of instruction followed by a testing period. Four different teaching methods were compared in these four groups. The investigator found no statistical difference among the four groups. The pitch and run test, constructed by the investigator, was a reliable measuring instrument for the pitch and run shot.

West and Thorpe (51), in 1967, constructed an eight-iron approach test. Pilot studies were done in order to determine final test factors. The final test was administered to 424 college women classified as beginning golfers. The investigators established the validity and reliability coefficients of this test.

McKee (38), in 1949, constructed a test of the full swinging shot in golf. The purpose of this study was to construct a test that was diagnostic, as well as reliable, valid and objective. A second purpose was to determine the validity of using cotton balls in testing the full-swinging shot in golf.

The hard ball test was given to thirty women students and faculty members. The test consisted of twenty trials, each trial consisted of one full swinging shot using a five-iron. The cotton ball test was administered to women students and faculty members once in the spring and once in the fall. The subjects used number five and two irons. The investigator found that the hard ball test was a reliable and valid measure of distance, velocity and angle of impact for the full swing shot in golf. The angle of deviation was less reliable. In the cotton ball test, the range was a reliable and valid measure of the result of the full swinging shot in golf. It was suggested by the investigator that, even though the diagnostic value of the test was impaired, it had many advantages over the hard ball test because a smaller area could be used for testing and because it was more economical of time.

Alderman (29) investigated two different methods of holding a golf club. The purpose was to ascertain the difference between the Vardon and spread grips in relation to range, velocity of the ball, angle of impact, and accuracy. The McKee test was given to all subjects to determine the initial level of ability. Two groups of male college students were instructed twice weekly for a period of eight weeks and were tested on three different occasions. One group was instructed for six weeks using the Vardon grip and then the spread grip for two weeks. In the other group, this instruction was reversed. The investigation did not support the contention of most experts that the Vardon grip is superior to another grip. It was found that the spread

grip was superior in accuracy but no other significant differences were exhibited.

Burgdorf (55) did a study to ascertain the relationship between strength in selected muscle groups and driving distance for women golfers using a number five iron. Thirty experienced golfers were given a strength test and tested with the use of a five-iron for driving distance. One group represented those who had driven the greatest average distance. The second group represented the group that had driven the least average distance. The significant findings showed the group averaging the longest distance did have more strength in the shoulder areas.

Putting Studies

The respiration of golfers during the drive and the putt was investigated by Schudel. (48) The purpose of this study was to determine whether the respiratory adjustments in performing these acts of skill were individual peculiarities or common to all. Ten trained male golfers and nine untrained golfers were used. A technique was developed for graphically recording the respiratory movements during the drive and putt. The trained golfers' patterns were about the same during the drive and the putt. There was deep inspiration of the breath and then the breath was held until the follow through had been completed. The untrained subjects presented no definite respiratory pattern. It required approximately one second to execute the putt or the drive by both trained and untrained golfer.

Kelliher (35) used beginning golfers to discover relative ability when using the conventional and the croquet styles of putting. Subjects were instructed in the basic fundamentals of putting using both styles of putter. The test consisted of putts of six, fifteen and thirty feet from the hole. Testing was done on (a) alignment and (b) alignment plus distance judgment. Fifteen putts were taken with each style putt. The results on the alignment test failed to disclose a superiority with either putter from six feet. At fifteen and thirty feet, the subjects were more accurate with the croquet putter. The investigator found that with both putters there was a tendency to stroke the ball to the right side of the hole from all distances tested.

Neal and Anderson (39) constructed a device to measure accuracy of aim with conventional and croquet golf putters. The device consisted of a metal plate which held either a croquet or conventional style putter. The putter could be rotated freely around a vertical axis. Accuracy of aim was measured by a slide projector that was turned on after each trial of aiming. The projector threw a beam of light on a mirror glued to the putter face. The light was then reflected onto the measuring scale that was marked in terms of degrees of deviation from perfect aim. Twenty-four male students were used in this experiment. They were assigned to six groups and tested. The test consisted of aiming a putter five times at three distances. The target was placed five, ten and fifteen feet away from the putter. Errors of the

five trials were summed for each subject and these sums became the scores analyzed. The average error of aiming with the conventional putter was 2.82 degrees while the average error with the croquet putter was 1.27 degrees. The difference was statistically significant and clearly indicated the advantage of the croquet putter in terms of accuracy.

Finding reliable tests which would be useful in the construction of a test or test battery for measuring an individual's ability to play golf was the purpose of a study done by Autry (53) in 1937. She constructed driving distance tests for indoor and outdoor testing. An outdoor test of approaching was constructed and an indoor test for putting. Only the outdoor driving test was found to be a reliable measure and it was reliable only after the use of a predictive formula.

A study in 1966 by Bowen (30) investigated putting errors of beginning golfers using different points of aim. One hundred college students were divided into two groups. The experimental group putted while looking at the hole. The control group looked at the ball while putting. Instructions in putting were given before testing. The test consisted of putting a ball twenty-five times from three different distances over four types of terrain. The three distances were fifteen, twenty-five and thirty-five feet. The four terrains were level, uphill-sidehill, downhill-sidehill and the undulating surface. The investigator found no significant differences between the two visual orientation methods. He did find that characteristic errors did appear among

beginners which were influenced by the distance putted and the variations in terrain. The characteristics indicated beginners tend to putt long on all surfaces at fifteen feet but tend to leave putts short on the medium (twenty-five feet) to long (thirty-five feet) holes on uphill terrain. A significant tendency was seen, in both groups at fifteen and thirty-five feet, to putt to the left of the hole.

As early as 1931 Melvin Clevett (33) realized the need to measure more accurately the effects of teaching in physical education. He devised his own indoor test to determine whether one means of instruction in golf was better than another. Clevett used three groups in this study. The Psychological group consisted of twenty-five male college students instructed in the use of the putter first and three other clubs later. The Logical group consisted of twenty-six male college students instructed in the use of the brassie first and three other clubs later. The Control group of twenty male students and faculty members received no instructions, did no practicing, and did very little playing during the experiment. A series of tests was given before instruction, at the end of four weeks of instruction, and six months after final instruction. Clevett did all the instruction, and devised and administered the test using the brassie, midiron, mashie and putter. It is assumed that he considered the use of these clubs the important components of the sport and the ones to be measured in determining a player's golfing ability. There was no attempt to establish the

reliability or validity of these tests. He used group data and compared the efficiency of the three approaches to teaching by the per cent of loss and gain resulting for each method.

The brassie and midiron test was administered using the same equipment and scoring. Accuracy was the determining factor in both tests. The putting test was administered on smooth carpets which were twenty-seven inches wide and twenty feet long. The player stood at a starting line and putted at a circle (the size of a regulation hole) from distances of eight, fifteen and eighteen feet. The carpet was marked off in forty-eight squares, each square measured nine inches, and each square was given a numerical number. Distance and direction were the determining factors for scoring values. The following results were reported:

1. The Psychological procedure in teaching golf was somewhat better than the Logical. The ultimate gain of the Psychological group over the Logical group was 10 per cent.
2. The frequency of use of the various clubs indicated the putter was used in over 40 per cent of the shots during regular play.
3. Distance and direction were outstanding errors in putting.
    (a) Too far and poor direction - 46 per cent
    (b) Too short and poor direction - 25 per cent
    (c) Too short but good direction - 17 per cent
    (d) Too far but good direction - 12 per cent

Clevette did suggest a plan that might improve his putting test. The green should be slightly elevated and a sunken hole placed in the green so the putted ball would have to go into the cup instead of across the hole marked as a cup.

Lumpkin (59) conducted a study in 1945 with the specific purpose of devising and determining the reliability of an outdoor putting test. She found it necessary to record 154 shots to have a reliable test for use with individuals. Forty-two beginning and sixteen experienced golfers were used. The putting test for beginning golfers consisted of putting sixteen balls from distances of five, ten, twenty, and thirty feet. This made a total of sixty-four balls putted. The test was given in two applications, each consisted of putting eight balls from each of the four distances. The score for each ball was the number of putts required to put that ball into the cup. The only difference between the beginning group test and the advanced group test was that the beginning group used four different holes while the advanced group putted their four distances to one hole. The investigator found the reliability of this test was .74 and thus indicated it would be satisfactory for measuring skill of a group but could not be used to measure individual skill. One of the more interesting findings of Lumpkin's work was the fact that, in all cases, the longer the putt, the more difficult it was to make except for the thirty-foot putt which added very little difficulty to the test.

The Importance of Putting

"The importance of putting to scoring in the game of golf cannot be questioned," states Dr. Jack Adler. (28:46) It has been considered the common denominator of scoring in this game. From forty to fifty per cent of the strokes used in a round of golf are on the putting green. A par golfer whose scores average seventy-two makes approximately thirty to thirty-eight putts per round. A player who scores in the eighties uses from thirty-four to forty putts each round, and one who cards near one hundred takes from thirty-six to fifty shots on the putting green. (18)

"Among golfers the putter is usually known as the pay-off club, and how right that is!", states Bobby Locke.(14:119) One needs only to read the comments made by golfers in sports pages and sports magazines to realize the importance of their putting to their standing in a tournament. (44, 53) Player and Palmer agree that putting could be considered a game by itself. Smith says

> Yes, you drive for show. . . but you putt for dough - another way of saying that putting is the pay off - that it is one of the most important and exacting phases of your game. (23:76)

Of all the skills one must learn and practice in order to become a good golfer, the skill of putting seems to be the easiest to learn but the most difficult to master. A beginning golf skills test was constructed and given to over three thousand students at the University of Florida by Conrad Rehling. (46) One of the skills tested was putting. Evidence did show that the putt was the easiest of the strokes learned but the most difficult to master.

If putting is a skill easily learned and one that requires little strength, why cannot one achieve accuracy in performance more readily? Putting has four requirements (as criteria) for success:

1. Know and be able to apply correct techniques,
2. Know how to read and play the green contours,
3. Develop enough confidence to meet the situation at hand,
4. Be willing to practice, practice, practice, practice. (58)

With success in this part of a golf game, scores will surely go down fast for the professional, amateur or beginning golfer.

> Putting reflects more individualism than any other golfing skill. A person's mental and physical make-up greatly influences the manner in which he applies the fundamentals. Thus we may see as many putting styles as styles of the putter itself. Yet all fine performers have certain common elements of form without which accuracy and consistency would be lost. (1:38)

The grip, stance, ball placement and swing are the common elements of form necessary for consistently good putting, regardless of individual variations. "The most fundamental variation in putting is in the manner of holding the club," state Hicks and Griffin. (10:211) There are four basic grips employed by golfers: the overlapping, interlocking, reverse overlapping and the two-handed or baseball grip. Most instructors of beginning golfers teach the overlapping or the reverse overlapping. The reverse overlapping is often suggested because of the theory that the right hand controls putting, and with this

grip, all fingers of the right hand are in contact with the shaft. (10) Mildred Zaharias used the reverse overlap and made this comment concerning her grip, "My hands work together on a putt, but I have the feeling that the fingers and the forefinger and thumb of my right hand are doing most of the work." (27:108) Gary Player says, of the reverse overlap, "It gives me a feeling of togetherness between my hands, and this is good because I want them to work as a unit." (20:55) Bobby Locke(14), credited as an excellent putter, uses the overlapping grip and he believes "The art of putting lies in the tips of the fingers" (14:24), and that one should never change the position of the hands up or down the putter. Some of the other great putters, men like Walter Hagen, Bobby Jones, Horton Smith and Billy Casper, agree that each hand has a different role in the putt. The left hand acts as a guide and the right hand supplies the power. Each does its part in the stroke, but neither dominates the stroke. (23:120)

The putting stance does vary among golfers in relation to type (square, open or closed), width, and weight distribution. Most golf writers agree that a good stance in putting would be described as bent over from the waist, knees slightly flexed, eyes directly over the ball with weight on both feet or mostly on the left foot with right foot balancing. (4, 5, 26, 42)

Hicks and Griffin (10) suggest that weight should be evenly distributed and feet placed ten to twelve inches apart. Harry Vardon (25) advocates the importance of heels touching. Bell (4), Smith (23), Nicklaus (16), Berg (5), and Palmer (19) think it is

important that the stance be kept narrow but comfortable for the individual.

The ball is usually placed in front of the left foot or heel about four to six inches from the foot. Some players find success putting the ball from the center of their stance. Regardless of whether the ball is placed toward the forward foot, centered or toward the back foot, it should be placed in relation to weight distribution.

There are two methods of putting - wrist putting and firm wrist putting. "Beginning golfers usually find the firm wrist more effective," stated Bolstad, Griffin and Rotvig. (6:73) The firm wrist putt is a stroke that is made with the arms swinging from the shoulders while the wrist stroke is done with the wrists only. When striking the ball, a smooth continuous stroke may be used or a tap putt. In a stroke putt, the club follows through the same distance as the length of the backswing. The tap putt is a crisp movement that contacts the ball and has very little follow through.

Peggy Bell (4) recommends these basic rules for stroking the ball: keep the putter blade low to the ground, stay motionless with the body and head, and keep eyes focused on the ball during contact. Smith (23) agrees that the swaying of the body or smallest movement of the head will throw the ball off line. There is a tendency among professional golfers to keep the putter head close to the ground throughout the stroke and to cut down their backswing, with a good follow through. Patty Berg

advocates this method and further states, ". . . the putter blade is square to the line of flight, even in the follow through, which is necessary for accuracy." (5:72)

In reviewing the recommendations of golf professionals and instructors, it was evident that various theories, concerning points of emphasis, had degrees of diversity due to personal experience and research. Distance was of greater concern than direction to most. Jones (13), Nicklaus (40), Smith (23) and Palmer (19) encouraged hitting the ball solid. Locke (14) and Novack (17) were more concerned with direction of the ball. Novack stated, "that eighty per cent of the short putts are pulled off the line to the left." (18:79) Bowen (30) agreed with this and indicated in his study that increasing problems of terrain accentuated both distance and direction of errors. Armour (2) and Bell (4) think judging the amount of roll and distance a putt needs is a long range learning process. Bolstad, Griffin and Rotwig (6) agree that in all putting there are two concerns combined into a single objective--distance and line--and that there are many combinations of rolls and slants on greens. Zaharias (27) suggested all contours and breaks of the green should be checked and a decision made as to the speed of the green by the grain before one attempts his putt.

General information about the grass and contours on a green are important and cannot be overlooked. Bermuda and bent varieties of grass develop grain and are the ones usually found on putting greens. The grass generally grows with blades

pointing in a certain direction. Blades pointing toward the hole cause a faster roll, and blades growing crosswise to the putt will cause the ball to travel 'with the grain'. Uphill putts must be stroked more forcefully than downhill putts. Side-hill putts are played to allow a roll toward the downward slope at the end of the putt. (18)

Two other elements necessary to become a good putter are confidence in one's ability and the willingness to practice. (15) Confidence is psychological and can usually be acquired by practicing fundamental skills. Novak states, "Confidence in putting is a state of mind that can only be developed through study and practice." (18:80) Player thinks "the proper mental attitude is necessary for consistent success on the green." (20:48) Turnesa (24) and Jones (12) agree that, without confidence, the finest putting stroke in the world is wasted. Vardon (25) thinks the important thing is to light upon a method that gives one the feeling that he is going to succeed and then to practice it. He thinks that trying too hard begets anxiety which is usually fatal in putting. Regardless of whether putting is psychocybernetic, intelligence, or the results of practice, it is usually necessary to become a good putter before you can consistently lower your score in a round of golf.

Summary

A survey of literature was made in an attempt to find a valid and reliable putting test for accuracy using an indoor

green. Studies which included putting testsfor accuracy were Kelliher (35), Neal and Anderson (39), Autry (53), Bowen (30), Clevett (33) and Lumpkin. (59) Only Kelliher, Autry, Clevett and Neal and Anderson tested putting accuracy indoors. In each case, the test was designed to putt a certain number of balls to a given point or target on a flat surface. None of the studies revealed either a satisfactory indoor putting test or surface. Suggestions pertaining to both outdoor and indoor tests were useful, however, in determining contours, distances of holes, number of holes and number of trials needed to construct a putting green and a putting test for accuracy.

# CHAPTER IV

## PROCEDURES

The plan of this study was to construct an indoor putting green, to devise a putting test for accuracy, and to establish the reliability and validity of the test.

## INDOOR PUTTING GREEN

In order to get a true indication of putting accuracy, it was necessary to construct an indoor green that possessed as many of the realistic features of a real green as possible. Features such as cost, size, mobility, surface grain and contours were considered. An indoor putting green, with breaks and elevations, and which would accommodate five holes, was decided upon.

### Sub-Surface

An architect was consulted about the design and materials necessary for the sub-surface. Several ideas were considered. One was to build a wooden frame filled with sand and cement, shaped to suit and then moistened to form a stable surface. This was rejected because of immobility and the mess that would be created. Another feasible idea consisted of cut and glued cardboard but this too was rejected due to excessive weight.

The cardboard idea, however, brought about thoughts of lighter materials which could be cut to obtain contours of the

desired elevations. An investigation of several types of plastic materials proved "Styrofoam" to meet the requirements of construction. Styrofoam, an expanded plastic manufactured by Dow Chemical Company, was found to cut and sand easily. In addition to these two basic requirements, it was readily available and reasonable in cost. Therefore, styrofoam was the material selected to build the sub-surface.

Construction

A scale drawing was prepared with the materials and their characteristics in mind. The surface had to be simple with as little "two-way" bend as possible. The sheet size of the styrofoam and thicknesses also played a major part in the design. After the design was settled, two plans were drawn. One was a grid that could be transferred to the styrofoam at full size scale. The other was drawn to determine quantities of materials necessary for the complete job.

Actual construction of the sub-surface consisted of five steps:

1. The grid was transferred from the plan to the styrofoam.
2. Styrofoam was then cut to the desired shape.
3. Sharp edges were sanded from the pastic. This was necessary to obtain a smooth rolling grade similar to natural conditions.
4. The styrofoam was placed and glued into positions with vapor barrier adhesive. The adhesive was

difficult to work with but did not dissolve the plastic styrofoam as so many adhesives do.

5. The entire surface was covered and glued with one layer of styrofoam to provide a smooth, even texture.

Refer to Appendix A for a series of figures showing the development of the sub-surface.

Surface

Several outdoor-indoor carpet samples were examined and putted on by experienced golfers. One sample, similar to astro-turf, seemed to possess many of the same qualities as real grass. The qualities were color, texture and, most important, grain patterns. One roll (twelve feet by seventeen feet) of this carpet was ordered on December 9, 1969.

The sub-surface was placed in the indoor golf room at The University of North Carolina at Greensboro. It was then covered with the outdoor-indoor carpet ready to be measured and cut for the five regulation holes. The holes were measured, marked and cut. The distances, contours and grain patterns from starting marker to each hole were different. The first hole was measured for a three-foot, straight-in putt that ran across the grain. The second and longest hole, measured fifteen feet with a three inch break from left to right, uphill and against the grain. Hole three, a "five-footer," broke downhill one inch, right to left, and against the grain. Number four was an eight-foot putt going uphill one inch and across the grain. The fifth, and

most difficult was a thirteen and one-half foot putt that broke downhill three inches from right to left and moved against the grain.

A small whiteheaded thumbtack was placed at the proper distance from each hole to designate the exact starting position for each hole. A roofing nail, covered with white adhesive tape and numbered in red, marked the number of each hole. These markers were anchored into the carpet and styrofoam, visible enough to permit placing the ball at the proper place and yet not conspicuous enough to disturb the student. A scaled figure of the final plan for the indoor green is located in Appendix B.

## TEST DESCRIPTIONS

### Indoor Putting Test

The Indoor putting test consisted of putting one ball into five holes on an indoor artificial green. The subject was to place a ball on or behind the white marker of hole number one. The subject then attempted to putt the ball into the first cup. If the ball went in on the first attempt, he recorded his score and moved on to hole two. However, if the ball failed to go into the cup on the first putt, the subject moved up to the ball, putted it until the ball went into the hole. Progression was then to the second hole, third, fourth, and the fifth in that order.

If a ball was putted off the green, a stroke penalty was added to the total score on that hole. The subject was allowed

to replace the ball six or eight inches from the edge, near the point of exit but not nearer the hole, and continue putting.

The score for each hole was the number of strokes required to putt a ball into the cup. The score for the entire test was the total strokes needed to putt the five-hole green.

Two subjects were allowed to take the Indoor putting test at the same time. Due to the size of the green, however, the second subject could not start the test until the first one had completed three holes of play.

Outdoor Putting Test

The outdoor practice green was a rectangular shaped putting area approximately thirty-five feet by one hundred feet, maintained by the greenskeeper. It was similar to greens found on regular golf courses except for size, shape and the fact it had nine holes instead of one.

Golf instructors used this green to teach putting and to administer a departmental putting test to golf students. They considered this test a good one for measuring putting accuracy. Statistical analysis of this test had not been calculated to establish the validity and reliability. Therefore, it was decided this was to be done by the investigator in this study.

The outdoor test consisted of putting one ball around a nine hole putting course. Putts for three holes were six feet long; three holes were putted from twelve feet and three from eighteen feet. The holes were not arranged in any set pattern but were measured and marked wherever the greenskeeper had placed the cup.

A white paper arrow was placed at the starting point for each hole indicating the number, direction and distance of that hole. The arrow was secured to the green by a wooden tee and placed not to obstruct the subject's vision or ball.

Subjects were paired and each pair started on a different hole. One subject placed his ball behind the starting marker on that hole and putted until the ball was in the cup. The partner followed the same procedure. Subjects recorded their scores and moved counter clockwise around the green until they had completed nine holes of putting and scoring.

The score for each hole was the number of strokes required to sink the ball into the cup attempted. The score for nine holes was the total strokes used in putting all nine holes.

### Game Play Putts

The golf course was a nine-hole, par thirty, golf course. It was impossible for all holes to be played in the limited fifty-minute class period. Therefore, students played different holes on different days and attempted to play all nine holes at some time during the semester. The subject recorded scores and putts during any game play. Some students played and scored their putts for as few as three holes while others were able to play and record twenty or more holes.

## ARRANGEMENTS

### Golf Instructors

A meeting of all golf instructors was held to discuss the purpose of the study, and the procedure that would be required,

and to ask for the use of their beginning golf students as subjects for this study.

Each instructor received a copy of the Indoor putting test, a scaled diagram of the indoor green, a sample score card and a statement explaining the purpose and plans for the study. These materials may be found in Appendix B. This information was discussed for clarification.

The instructors indicated their willingness to have all their beginning golf students participate in the study. They also agreed to explain and administer the tests to their students.

Arrangements were made with the building porter to vacuum the indoor carpet each testing day. He also checked the outdoor green for loose impediments and made sure all starting markers were in place.

Subjects

One hundred and seventy-one student data cards were filed in a box. This number represented all students enrolled in the beginning golf classes for the second semester of 1970. Six instructors, with classes averaging seventeen, instructed their class or classes in the basic fundamentals of golf. Putting techniques and fundamentals were part of the total instruction. Students were allowed to practice and play as much as possible during class time. However, due to short class periods of fifty minutes meeting twice weekly, practice and use of the fundamentals in play was limited. These students represent the subjects in this study.

Score Card

Printed score cards were prepared for the recording of indoor, outdoor and game play putts. A copy may be seen in Appendix B.

The game play section provided columns and rows enabling a subject to record scores for seventy-two holes of putts. The Outdoor test section was also set in columns and rows and provided space to record sixty-three holes of putts. The Indoor test section was arranged likewise and provided space to record putts for twenty holes.

A file box was made to hold all the score cards. Colors were assigned each instructor and used as dividers. Subjects' cards were filed behind their instructor's color and the day and time marked on the color divider. All cards were alphabetically arranged within the class. This procedure enabled subjects to find, record, and file their card quickly and easily. Identification of instructors and explanation about the filing box may be found in Appendix B.

Balls and Clubs

Twenty-four new 90+ compression balls were furnished for the Indoor and Outdoor putting tests. They were placed in a small bucket that was labeled "TESTING". These balls were used and returned after each class period. Regular practice balls were used during game play and for putting during game play. Each subject was allowed to use either his own putter or one furnished by the instructor.

Schedule

The weeks of April 20 and 27 had been scheduled for administering the Indoor and Outdoor tests. Time permitting, holes on game play were to be included, too. The suggested plan for student rotation during testing was from the Outdoor test to the Indoor test and then to game play. It was suggested that on the first testing day each student was to complete one administration of the Outdoor test, one of the Indoor test and as many game play holes as possible. It was estimated that the Outdoor test would take fifteen to twenty minutes of the student's time, the Indoor test would take another five minutes, leaving about thirty minutes for game play. The second testing day was to follow the same plan as the first day. The third day of testing called for each student to take one Indoor test and move to the regular golf course for game play. The fourth and final test day was to be a repeat of the third testing day. Most instructors followed this plan. The requested data for four administrations of the Indoor putting test, two of the Outdoor putting tests, and as many playing scores as possible were collected by those using the plan. An extended time allowed for the playing and recording of playing putts.

Some instructors did deviate from the original plan for one reason or another. Some collected all data needed on the Indoor and Outdoor tests the first week. They thought it would be simpler and more economical of their students' time to use two complete class periods for the Indoor and Outdoor tests enabling their class to use all their time in game play the

second week and weeks thereafter. This group did record all scores on the Indoor and Outdoor tests requested and in some cases recorded more playing scores than the group following the suggested plan.

## TREATMENT OF DATA

Not all students enrolled in the beginning golf classes were used in the treatment of data. Four of the 171 students withdrew from class before testing was started. Another student apparently misunderstood scoring procedure. Several were absent on two of the testing days and did not record enough scores. Other students, for unknown reasons, recorded scores for only one test. Therefore, the number of subjects for each calculation varied.

The reliability and validity of the Indoor and Outdoor tests were computed using the Pearson product-moment coefficient of correlation. Reliability was calculated from actual scores for the Indoor and Outdoor putting tests. Two calculations for both tests consisted of (a) first trial versus second trial and (b) best trial versus second best trial. The third method of calculation for the Indoor test used the first two trials versus the second two trials.

The validity criterion for the Indoor and Outdoor putting tests was the putting ratio from game play. Ratios were found by dividing the total number of putts by the total number of holes played by the subject. Another validity correlation was

computed for the Indoor test using the Outdoor putting test as the criterion.

# CHAPTER V

## PRESENTATION AND INTERPRETATION OF DATA

The primary purpose of this study was to establish an Indoor putting test for beginning golf students. The literature reviewed did not reveal a valid and reliable test of putting accuracy for indoor use. Therefore, it was necessary to construct a test to evaluate putting accuracy and to establish the reliability and validity of the test. The second purpose of this study was to establish the validity and reliability of an Outdoor putting test already in use by golf instructors in their teaching and testing of beginning golf students at The University of North Carolina at Greensboro.

Two putts per hole is considered by most authorities as good putting accuracy during game play. With this same requirement placed on the Indoor and Outdoor putting test, the investigator believed there would be a high relationship between the scores made by the subjects on an Indoor test for accuracy and their scores on either an Outdoor putting test for accuracy or on their putting scores in actual game play.

The Indoor, Outdoor and game play tests, described in the preceding chapter, were administered to 171 students that elected to enroll in beginning golf classes during the spring semester of 1970 at The University of North Carolina at Greensboro. Of this number, four withdrew before classes started. The remaining 167

students, averaging about seventeen in each of ten sections, were instructed and tested by six members of the Department of Health, Physical Education, and Recreation at the University. Information concerning instructors, sections, subjects enrolled, withdrawals and those tested is presented in Table I. Data gathered by the instructors from these subjects represent the data analyzed here.

TABLE I

NUMBER OF INSTRUCTORS, SECTIONS, AND STUDENTS INVOLVED IN THIS STUDY

| Instructor | Number of sections | Enrolled | Subjects withdrew | Tested |
|---|---|---|---|---|
| One | 3 | 46 | 0 | 46 |
| Two | 2 | 35 | 1 | 34 |
| Three | 1 | 18 | 0 | 18 |
| Four | 2 | 35 | 1 | 34 |
| Five | 1 | 18 | 1 | 17 |
| Six | 1 | 19 | 1 | 18 |
| Total | 10 | 171 | 4 | 167 |

Not all subjects instructed and tested were included in the analysis of each test. As indicated in Table II, the number of subjects taking each test did vary. Variations were due to the recording of too few scores and to absentees. Limited time caused several sections to record no scores for the third and fourth trials of the Outdoor and Indoor putting tests.

One hundred and sixty-seven subjects participated in the Indoor putting test. All students' scores were used in ratio calculations for validity, but four students' scores on trial one, five on trial two, forty-three on trial three and fifty-six on trial four, that did not finish the test, could not be used in establishing the reliability of the Indoor test.

One hundred and fifty-five subjects participated and recorded scores for the Outdoor test and these subjects' scores were used to establish the validity of the Outdoor test. However, twelve subjects on trial one, twenty-two on trial two, seventy-seven on trial three and eighty-eight on trial four participating and recording scores could not be used to establish reliability because they had not completed the test.

The Outdoor test, calculated on actual scores, ranged from 155 participating subjects on trial one to seventy-nine on trial four. The variation is understandable since two completed trials had been requested and more trials if possible. However, enough subjects did participate in trials three and four that it was decided to use these data in a further calculation for reliability.

TABLE II

NUMBER OF SUBJECTS PARTICIPATING IN EACH CALCULATION FOR ESTABLISHING VALIDITY AND RELIABILITY OF THE INDOOR, OUTDOOR AND PLAYING TESTS

| Number Enrolled | Validity | | | Reliability | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Indoor Test | Outdoor Test | Playing Test | Indoor Trial 1 | Indoor Trial 2 | Indoor Trial 3 | Indoor Trial 4 | Outdoor Trial 1 | Outdoor Trial 2 | Outdoor Trial 3 | Outdoor Trial 4 |
| 15 | 15 | 15 | 15 | 15 | 15 | 15 | 14 | 15 | 14 | 9 | 2 |
| 17 | 17 | 17 | 17 | 17 | 17 | 17 | 16 | 17 | 15 | 13 | 5 |
| 14 | 14 | 14 | 14 | 14 | 13 | 13 | 14 | 14 | 13 | 12 | 10 |
| 16 | 16 | 14 | 16 | 15 | 15 | 13 | 12 | 14 | 8 | 0 | 0 |
| 18 | 18 | 15 | 18 | 18 | 18 | 17 | 15 | 15 | 15 | 1 | 0 |
| 18 | 18 | 17 | 18 | 18 | 18 | 18 | 18 | 17 | 16 | 0 | 0 |
| 17 | 17 | 16 | 15 | 17 | 16 | 1 | 0 | 16 | 15 | 15 | 15 |
| 17 | 17 | 16 | 17 | 17 | 16 | 13 | 0 | 16 | 15 | 6 | 2 |
| 17 | 17 | 14 | 17 | 14 | 14 | 0 | 0 | 14 | 16 | 16 | 16 |
| 18 | 17 | 18 | 18 | 18 | 18 | 17 | 17 | 17 | 18 | 18 | 18 |
| 167 | 167 | 155 | 165 | 163 | 162 | 124 | 111 | 155 | 146 | 90 | 79 |

Calculations to establish reliability involved the actual putting scores for each of the three situations: Indoor test, Outdoor test and game play. Calculations to establish validity were based on ratios derived by dividing the number of putting strokes by the number of holes played.

## Reliability of the Indoor and Outdoor Tests

Reliability of the Indoor and Outdoor putting tests was computed using the Pearson product-moment coefficient of correlation from actual scores recorded by each subject. Calculations for both tests consisted of (a) first trial versus second trial, (b) best trial versus second best trial of four completed trials, and (c) the first two trials versus the second two trials for the Indoor test only. Table III indicates the reliability coefficient established in these three ways.

TABLE III

RELIABILITY COEFFICIENTS FOR THE INDOOR AND OUTDOOR PUTTING TEST

| Outdoor and Indoor test | Subjects | Number of holes | r |
|---|---|---|---|
| INDOOR | | | |
| First trial vs. second trial | 162 | 5-5 | .23 |
| Best trial vs. second best trial | 132 | 5-5 | .74 |
| Trial one and two vs. trial three and four | 111 | 10-10 | .29 |
| OUTDOOR | | | |
| First trial vs. second trial | 145 | 9-9 | .24 |
| Best trial vs. second best trial | 79 | 9-9 | .69 |

One hundred and sixty-two subjects recorded scores for the first and second trials on the Indoor test. A reliability coefficient of .23 was obtained. Calculation of the Indoor test using the best trial versus the second best trial was .74 and trials one and two versus trials three and four revealed a correlation coefficient of .29. All three coefficients are unacceptable. It is worth remembering, however, that only twenty holes were putted for the entire four trials on the Indoor green. This number represents only two more than allotted in regulation eighteen-hole play. Using the best and second best scores, an instructor, without the use of a golf course or an outdoor putting green, might establish some idea as to the putting accuracy of student golfers using this test. Adding to the number of trials would increase the reliability.

On the Outdoor test, reliability coefficient of .24 resulted for the first trial versus the second trial. The best trial versus the second best trial resulted in a correlation coefficient of .69. Again, each of the coefficients represents an unacceptable correlation. More interesting was the comparison of the reliability of the Indoor best trial versus second best trial of .74 on ten holes with the Outdoor test of best trial versus second best trial of eighteen holes and a correlation of .69. This further confirms the investigator's belief that an Indoor putting test can measure putting accuracy as dependably and in less time and cost than an Outdoor green test.

Test Validity

A review of literature did not reveal a valid test for measuring putting accuracy indoors for beginning golfers. Therefore, it was assumed that putting scores collected during regular game play would produce a valid measure of one's putting accuracy. This was the standard used to compare the Indoor and Outdoor test scores.

The statistical technique employed for ascertaining validity of the Indoor and Outdoor tests was the Pearson product-moment coefficient of correlation. The criterion for the Indoor and Outdoor putting test was the putting ratio from game play. Ratios were found by dividing the total putt score by the total number of holes played by the subject. Another validity correlation, computed for the Indoor test, used the Outdoor putting test ratios as the criterion. (See Table IV)

TABLE IV

VALIDITY COEFFICIENTS FOR THE INDOOR AND OUTDOOR PUTTING TESTS USING RATIO SCORES

| Tests | Subjects | r |
|---|---|---|
| Indoor test ratios versus playing ratios | 165 | .26 |
| Outdoor test ratios versus playing ratios | 155 | .26 |
| Indoor test ratios versus outdoor test ratios | 155 | .32 |

The Indoor test ratios and playing ratios of 165 subjects produced a correlation coefficient of .26. The Outdoor test ratios and playing ratios of 155 subjects established a correlation coefficient of .26 also. The third correlation produced a coefficient of .32 between the Indoor test ratios and the Outdoor test ratios of 155 subjects.

There is reason to believe that the power of concentration in putting is not as great during game play as when putting on an indoor or outdoor putting green because of (a) the social aspects of group play during the game play, (b) the different contours, terrains, and distances of each putt, and (c) varying weather conditions that might affect the test results.

The validity coefficients reported in Table IV, page 38, show a significant relationship for the number of subjects involved. While the coefficients are not sufficiently high to meet validity standards, there is more than a chance relationship between the measures. The original hypothesis was that there would be high relationships between the scores made on the Indoor putting test for accuracy and either the Outdoor putting test or putting performance in game play. This did not prove to be the case.

# CHAPTER VI

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## SUMMARY

The purpose of this study was to establish an Indoor putting test for beginning golfers. An additional purpose was to construct an indoor putting green that would enable instructors to teach and test putting indoors. A third objective was to establish the reliability and validity of an outdoor putting test used at The University of North Carolina at Greensboro by golf instructors to test beginning golf students in putting accuracy.

### Tests

The Indoor putting test consisted of putting one ball into five holes on an indoor green. The holes were distances of three, fifteen, five, eight and thirteen and one-half feet, in that order. The score for the entire test was the total strokes needed to putt the five-hole green. Four administrations, a total of twenty holes, were requested.

The Outdoor putting test consisted of putting and scoring one ball for nine holes on an outdoor practice green. Three holes were six feet; three were marked for twelve feet; and three were marked for eighteen feet. Two administrations, a total of eighteen holes, were requested and more if time permitted.

Putting scores from regular game play were recorded by each subject over a period of four to six weeks. Most subjects reported between ten to twenty holes played and scored. These scores were used as the criterion for determining validity of the Outdoor and Indoor tests.

Subjects, Instructors and Study Results

One hundred and sixty-seven beginning golf students, enrolled in beginning golf classes at The University of North Carolina at Greensboro during the spring semester of 1970, participated in the study. These students were in ten sections of golf, averaging about seventeen subjects and taught by six golf instructors. Each section met twice weekly for a period of fifty minutes each. The duration of the study was one semester with two weeks scheduled for testing and recording indoor and outdoor putting scores. The playing and recording of game play scores extended over a four to six weeks' period.

Test Reliability and Validity

The Indoor putting test revealed reliability coefficients of .23 when the first and second trials were correlated; .74 when the best of four trials was correlated with the second best of four trials; and .29 when trials three and four were correlated with trials one and two.

Outdoor putting test reliability coefficients were .24 on the first trial versus the second trial, and .69 when the best trial was correlated with the second best trial.

Correlation of the Indoor putting ratios with playing score ratios produced a validity coefficient of .26. The Outdoor putting score ratios correlated with playing score ratios at .26 also. A validity coefficient of .32 was obtained from putting ratios on the Indoor and Outdoor putting tests.

## CONCLUSIONS

The following conclusions were drawn on the basis of the analysis of data:

1. The Outdoor and Indoor putting tests are not valid measures of putting skill on the basis of statistical evidence. They appear, however, to have some face validity. The Indoor green is recommended as a motivational tool and as a practice device during inclement weather.
2. The reliability of .74 on the Indoor putting test was encouraging. With additional trials, the reliability coefficient could be raised to an acceptable level.
3. Instructors and subjects seemed to think that the indoor green was more realistic than other artificial putting surfaces they had used in regard to grain patterns, terrains, contours, and a game-like putting situation.

# RECOMMENDATIONS

The following suggestions for further study are made on the basis of the writer's experience with this particular study:

1. Increase the length of the indoor putting test to include ten holes or possibly twenty holes. The five holes could be putted twice or four times using different starting points on each hole on each trial. The five holes could be putted in order and in reverse for completion of ten holes for two trials. This would lengthen the test but it could still be taken within a thirty-minute period and it would present more realistic conditions found in game play.
2. Allow more time for putting practice before testing.
3. Test intermediate golfers to determine if practice and experience enhance putting accuracy during game play, indoor putting or outdoor putting.
4. Investigate what motivational contributions a teaching device such as the indoor green has upon putting accuracy.

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# APPENDIXES

# APPENDIX A

## Materials and Construction Plans for the Indoor Green

## MATERIALS FOR SURFACE OF INDOOR GREEN

Outdoor-Indoor Carpet — World Carpet, Inc.

Invoice Number: 009891 — Shipped from Dalton, Georgia

Invoice Date: 12-9-69 — Salesman 108 BD

| Quantity | Description | Style | Color | Width | Length | Roll Number |
|---|---|---|---|---|---|---|
| 1 | Roll | 0045 | 0045 J | 12 | 17 | 144207 |

## MATERIALS FOR SUB-SURFACE OF INDOOR GREEN

Adhesive

Vapor Barrier Adhesive

Kaiser brand

Houston, Texas

Permaspan Expanded Polystyrene

| Quantity | Description | |
|---|---|---|
| 11 | 1" x 24" x 8' | 176 Bd. ft. |
| 3 | 1" x 16" x 9' | 36 Bd. ft. |
| 8 | 1½" x 24" x 8' | 192 Bd. ft. |

Styrofoam

| Quantity | Description | |
|---|---|---|
| 10 | 1" x 16" x 9' | 120 Bd. ft. |
| 11 | 1" x 24" x 8' | 176 Bd. ft. |

Insulation Company — The Bonitz Insulation Co.
Greensboro, North Carolina

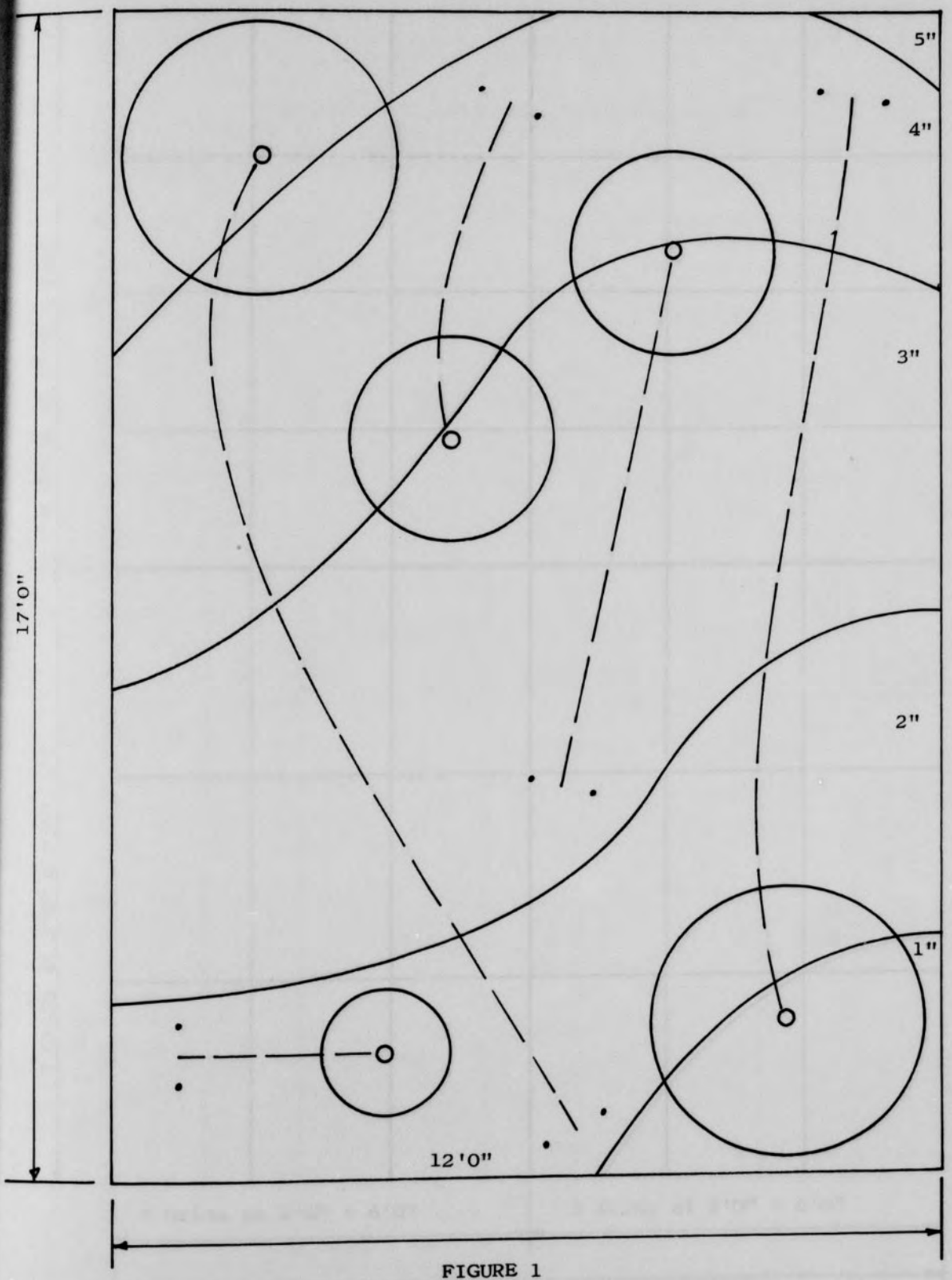


FIGURE 1

SCALED PLAN OF FINISHED INDOOR GREEN WITH CONTOURS

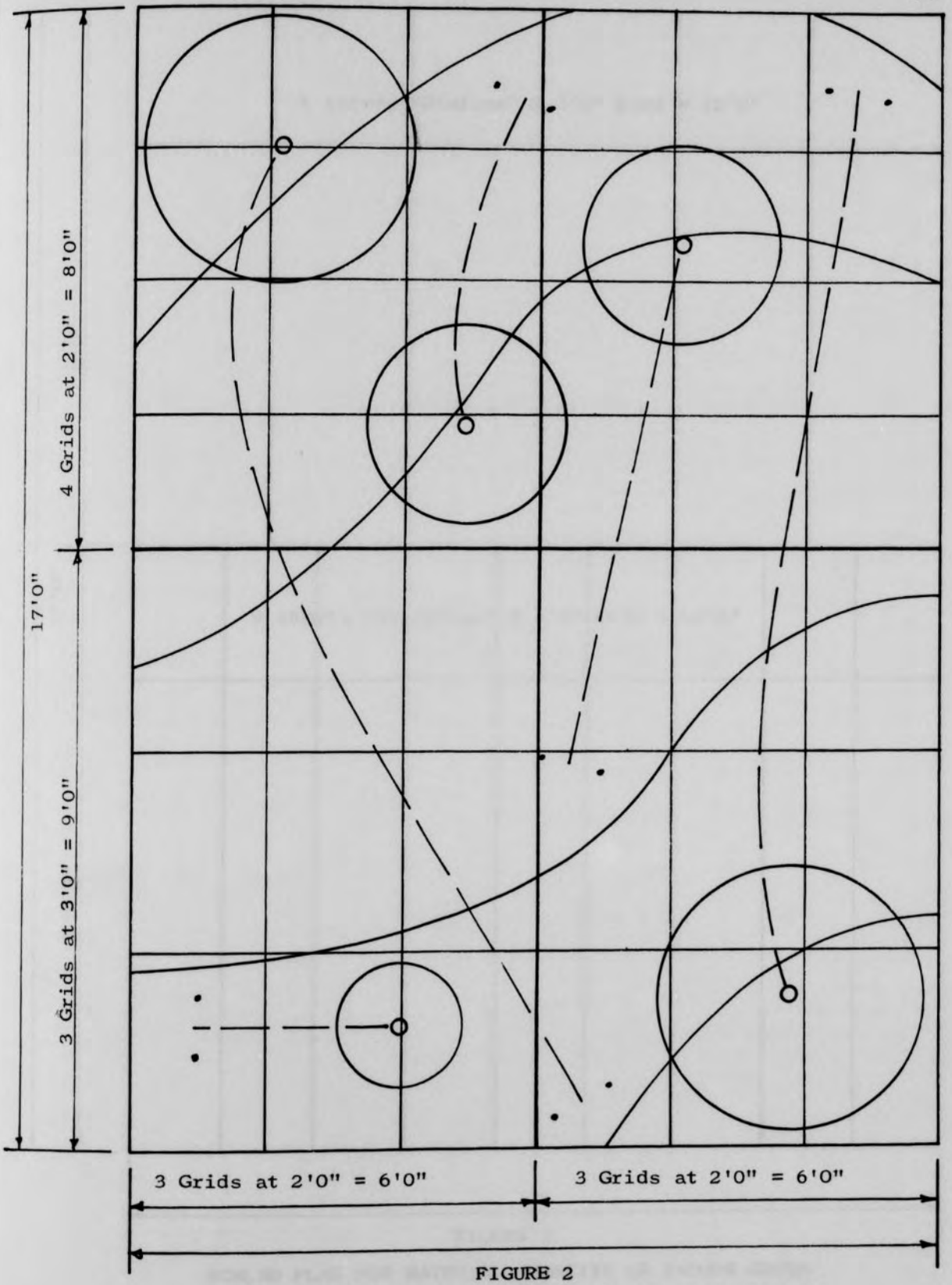


FIGURE 2

SCALED PLAN TO TRANSFER LAYOUT TO FULL SCALE MODEL

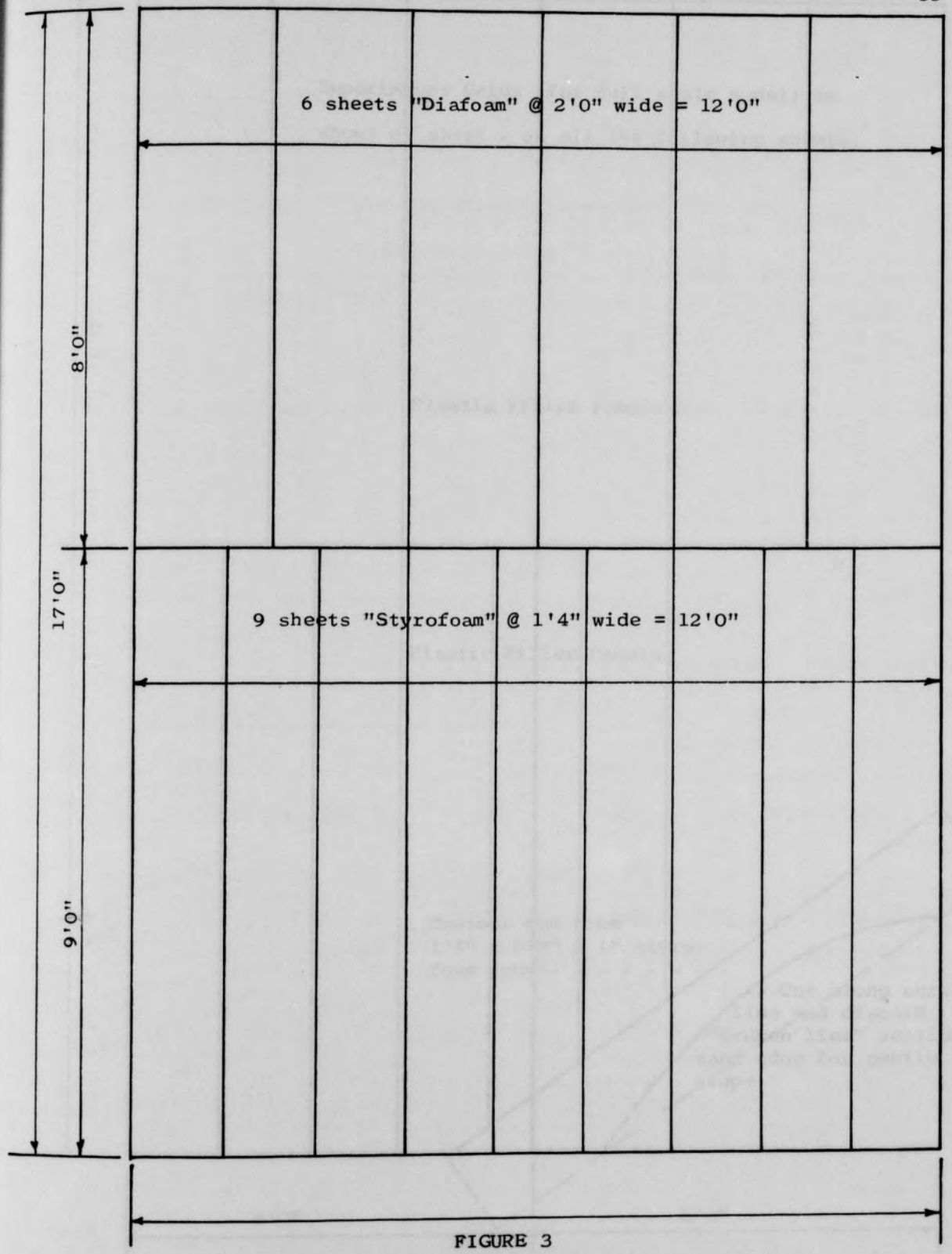


FIGURE 3

SCALED PLAN FOR MATERIAL QUANTITY OF INDOOR GREEN

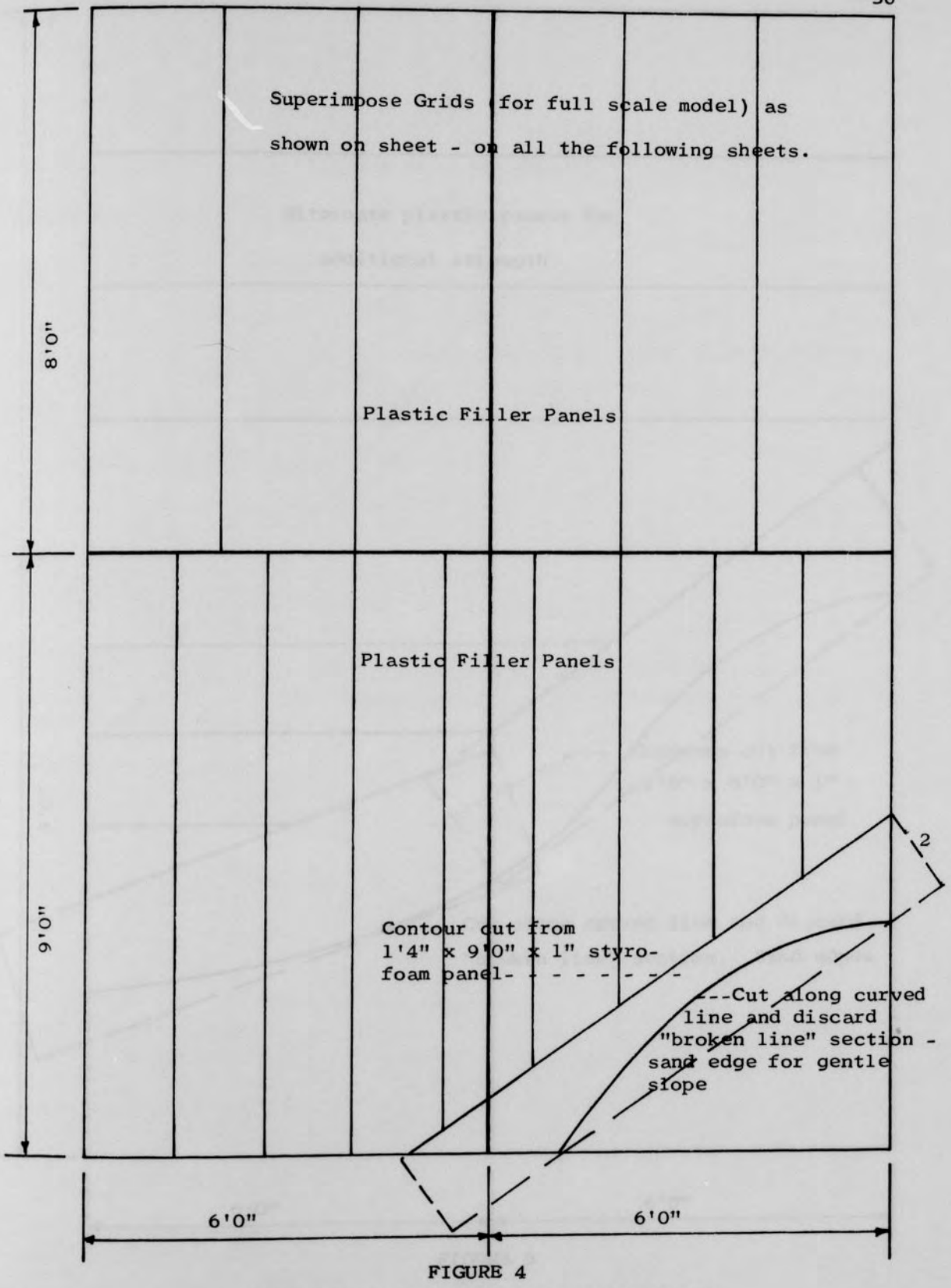


FIGURE 4

SCALED PLAN FOR INDOOR GREEN CONTOUR #2

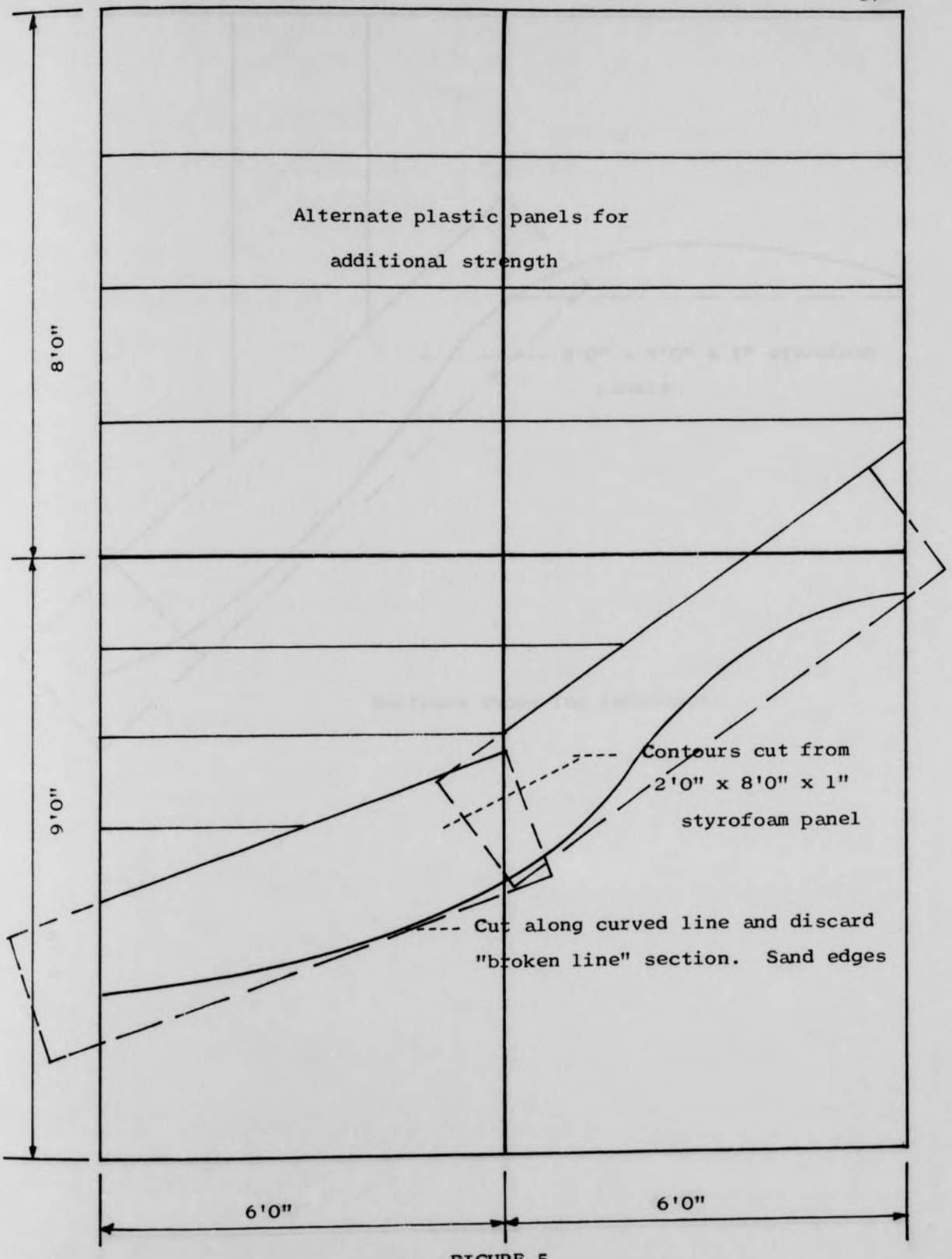


FIGURE 5

SCALED PLAN FOR INDOOR GREEN CONTOUR #3

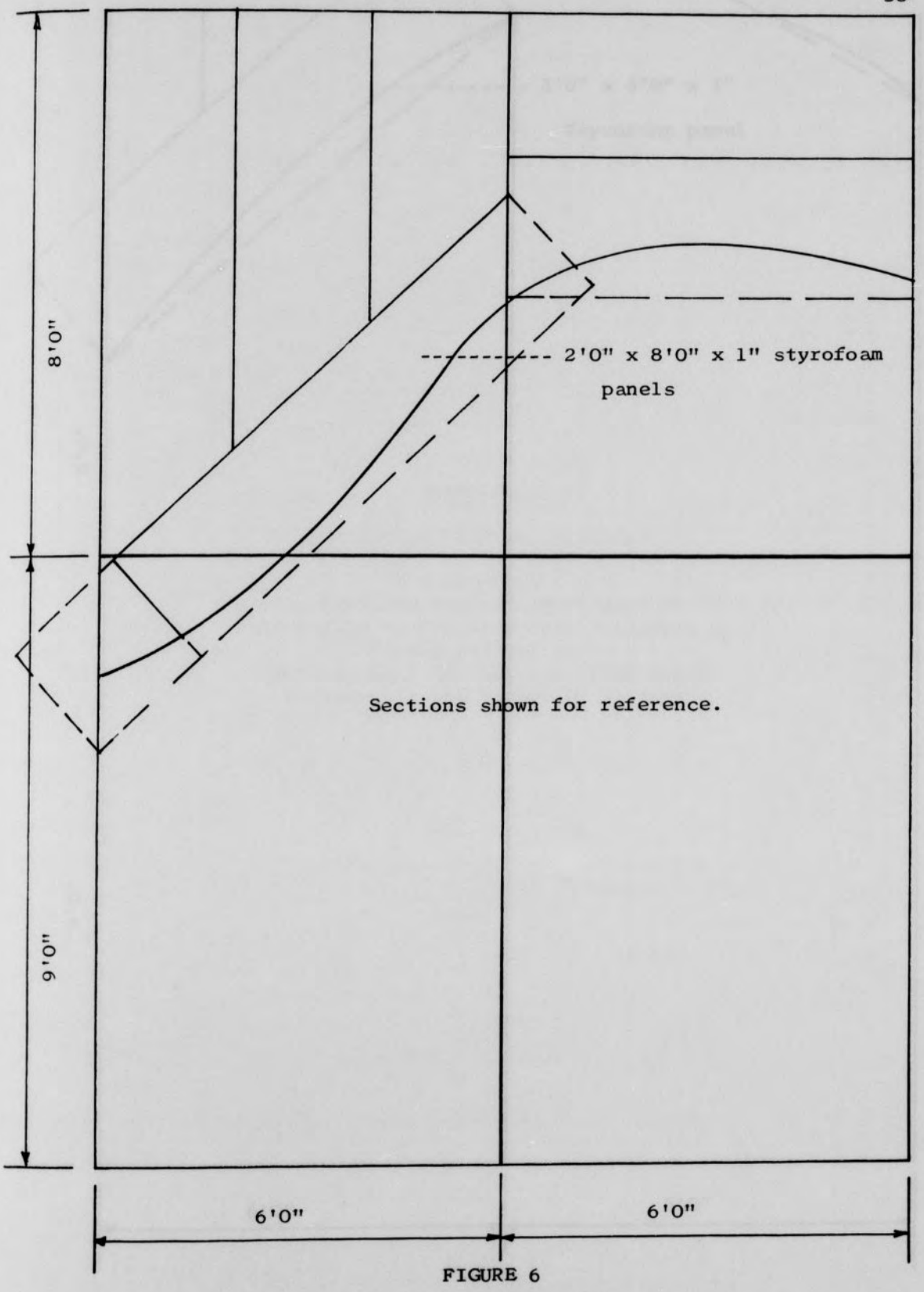


FIGURE 6

SCALED PLAN FOR INDOOR GREEN CONTOUR #4

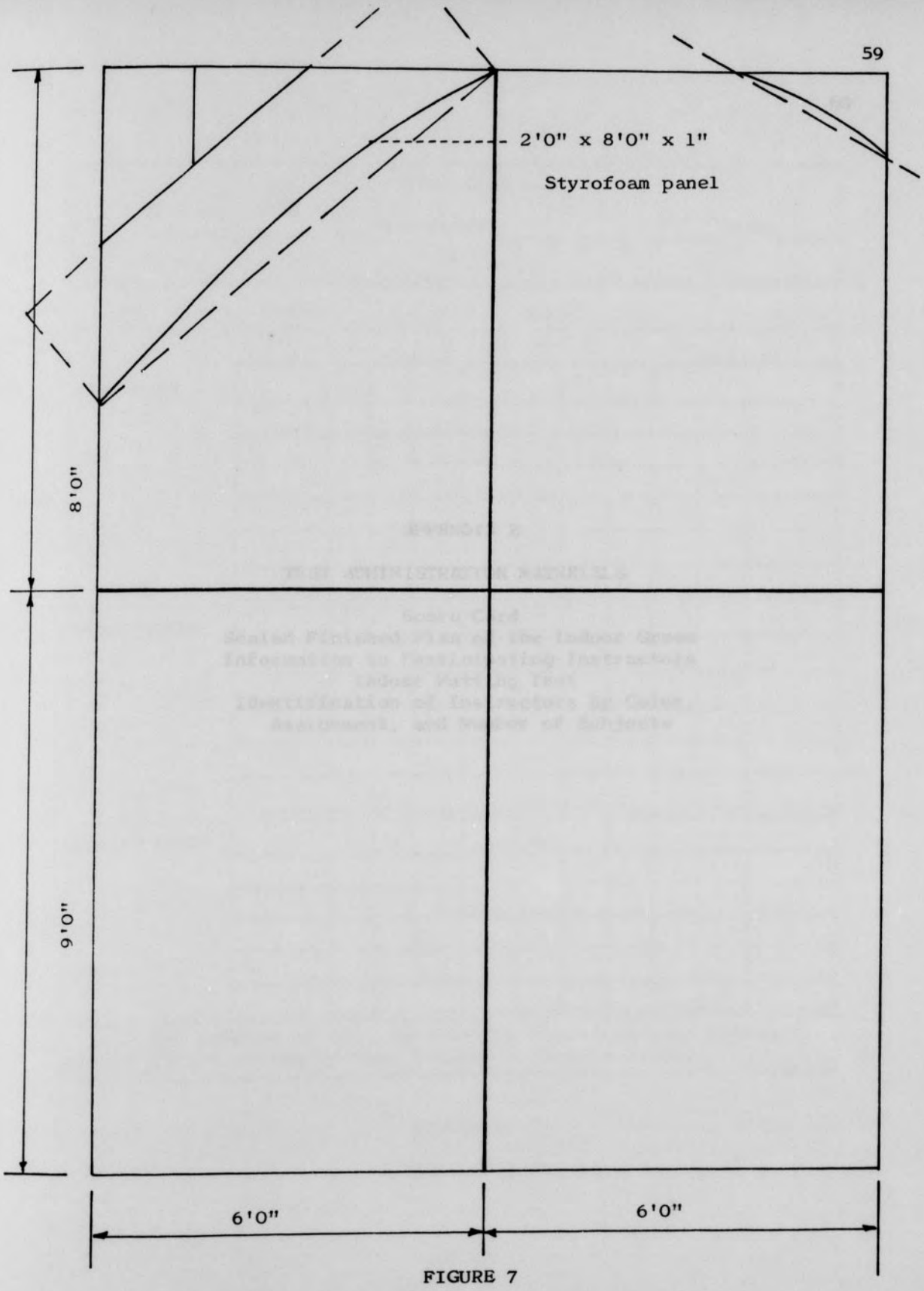


FIGURE 7

SCALED PLAN FOR INDOOR GREEN CONTOUR #5

# APPENDIX B

## TEST ADMINISTRATION MATERIALS

Score Card
Scaled Finished Plan of the Indoor Green
Information to Participating Instructors
Indoor Putting Test
Identification of Instructors by Color,
Assignment, and Number of Subjects

SCORE CARD

NAME _____ INSTRUCTOR _____ TIME _____

M T W T F

| TEST | DATES | HOLES | | | | | | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| GAME PLAY | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| SMALL GREEN | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| INDOOR GREEN | | 1 | 2 | 3 | 4 | 5 | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

The purpose of this card is for recording your putts.
Please circle all holes that include a penalty stroke.

FIGURE 8

SCORE CARD

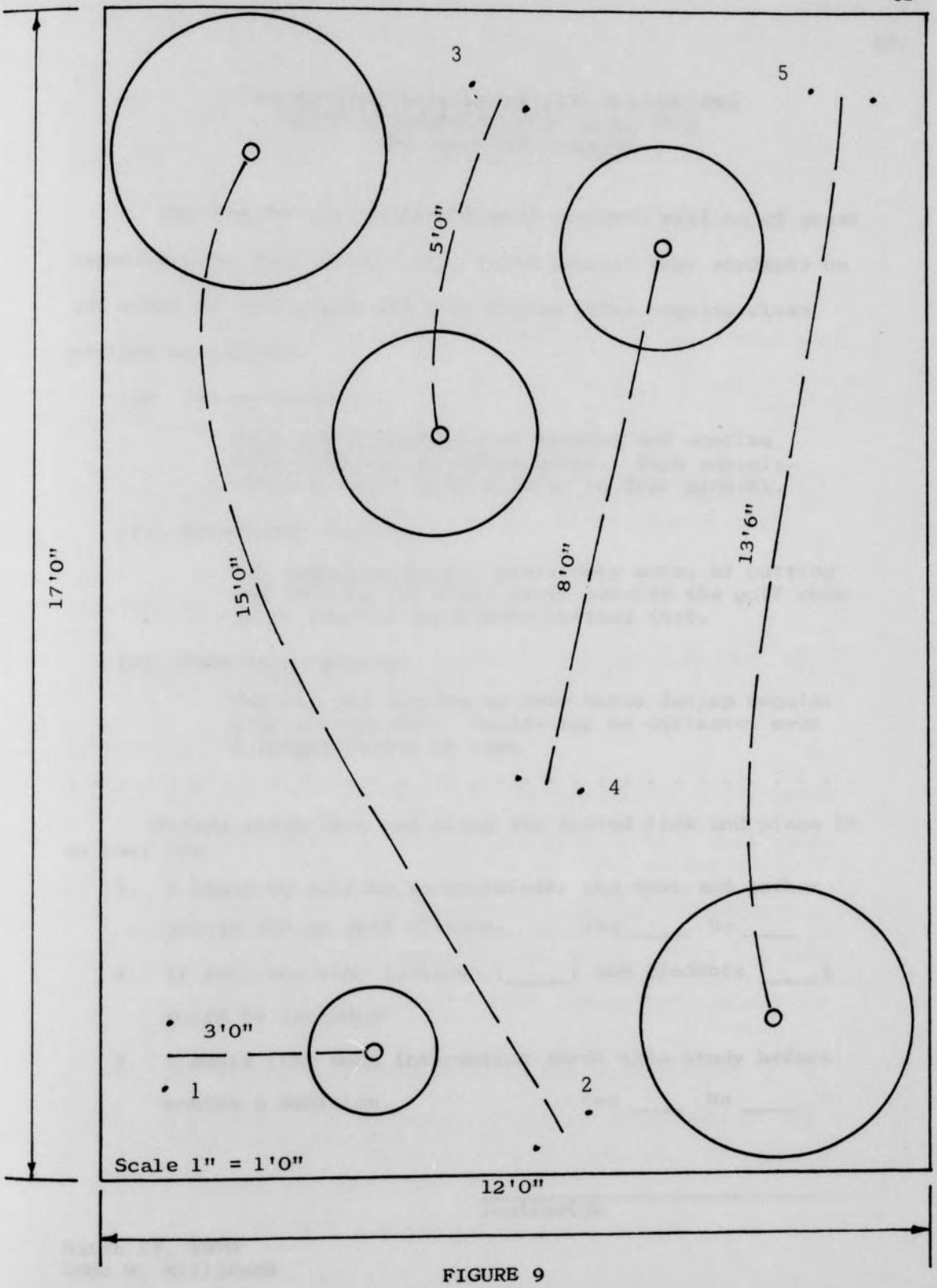


FIGURE 9

SCALED FINISHED PLAN OF THE INDOOR GREEN

INFORMATION TO PARTICIPATING INSTRUCTORS
ABOUT AN INDOOR PUTTING SKILL TEST
FOR BEGINNING GOLFERS

The use of your beginning golf students will be of great importance in this study. This would involve your students on the weeks of April 20th and 27th during their regular class periods as follows:

(a) Indoor Testing:

Four administrations of putting and scoring five holes on an indoor green. Each administration would involve three to four minutes.

(b) Department Testing:

Two administrations, preferably more, of putting and scoring the small green outside the golf room as in regular department putting test.

(c) Game Play Putting:

Putting and scoring as many holes during regular play as possible. Scores may be collected over a longer period of time.

. . . . . .

Please check then cut along the dotted line and place in my mail box.

1. I would be willing to administer the test and gather scores for my golf classes. Yes ____ No ____

2. If yes, how many sections (_____) and students (____) would be included?

3. I would like more information about this study before making a decision. Yes ____ No ____

_____
Instructor

March 13, 1970
Edna W. Williford

# INDOOR PUTTING TEST

PURPOSE:

To measure putting accuracy on an indoor putting green.

LEVEL AND SEX:

This test is developed for college men and women beginning golf students.

CLASS ORGANIZATION:

The class will rotate to the indoor testing green from the outdoor practice green. When the indoor test is finished the student will move on to the regular golf course for game play.

TIME ALLOTMENT:

One administration of this test should not take over three or four minutes per student.

FACILITIES AND EQUIPMENT:

1. One 12' x 17' putting area constructed of a styrofoam base and covered with an outdoor-indoor carpet similar to astro-turf. The green has five holes. Hole number one is a three-foot straight in putt, across the grain. Number two is a fifteen-foot putt breaking three inches uphill, with the grain. Hole three is a five-foot putt moving against the grain and breaking downhill one inch. Hole four is an eight-foot putt going uphill and with the grain. Hole five is a thirteen-foot, six-inch putt breaking downhill three inches and moving against the grain.
2. One hard 90+ compression ball for each student.
3. One putter per student. It may be either his or her own or one provided.
4. A filing box for score cards.
5. One score card and one pencil per student.

SCORING:

Each hole will be scored by counting the number of strokes it takes to putt the ball into the hole from the starting markers of that hole. If the ball rolls off the green it may be replaced six or eight inches from the edge, near the point it left the green, but not nearer the hole, adding one penalty stroke to your score.

INSTRUCTION:

Place a ball behind or between the starting markers on hole one. Putt and continue putting until the ball is holed out. Record your score and move to hole two. Using the same procedure as hole one, putt and record your scores for holes 2, 3, 4, and 5, in that order. No subject will start their first hole until the subject preceding them has completed three holes.

IDENTIFICATION OF INSTRUCTORS BY COLOR, ASSIGNMENT, AND NUMBER OF SUBJECTS

| Instructor | | Color Assignment | Section | Students |
|---|---|---|---|---|
| ONE | Miss Margaret Greene | Green | 3 | 46 |
| TWO | Dr. Rosemary McGee | Brown | 2 | 35 |
| THREE | Dr. Pauline Loeffler | Orange | 1 | 18 |
| FOUR | Miss Lynne Gaskin | Blue | 2 | 35 |
| FIVE | Miss Nancy Porter | Yellow | 1 | 18 |
| SIX | Miss Patricia Crowe | Pink | 1 | 19 |
| | Total | | 10 | 171 |

All instructors were members of the faculty of the Department of Health, Physical Education, and Recreation at The University of North Carolina at Greensboro. They instructed their class or classes in putting fundamentals prior to testing and administered all putting tests during the testing weeks.

Colors were assigned the instructor for the purpose of score card dividers. This procedure enabled students to find and file their score cards quickly and accurately.

# APPENDIX C

Raw Data

TABLE V

NUMBER OF SUBJECTS, HOLES AND PUTTING RATIOS FOR THE INDOOR, OUTDOOR AND GAME PLAY TEST

| Subject | Indoor Test | | Outdoor Test | | Game Play Test | |
|---|---|---|---|---|---|---|
| | Holes played | Indoor ratio | Holes played | Outdoor ratio | Holes played | Game play ratio |
| 1 | 20 | 2.10 | 36 | 1.94 | 11 | 2.72 |
| 2 | 20 | 2.25 | 36 | 2.14 | 7 | 2.43 |
| 3 | 20 | 2.10 | 36 | 2.81 | 8 | 2.50 |
| 4 | 20 | 2.05 | 36 | 2.11 | 16 | 2.56 |
| 5 | 20 | 2.00 | 27 | 2.22 | 11 | 1.81 |
| 6 | 20 | 2.10 | 34 | 2.44 | 10 | 2.60 |
| 7 | 20 | 2.15 | 27 | 2.19 | 15 | 2.40 |
| 8 | 20 | 2.45 | 27 | 2.44 | 10 | 2.50 |
| 9 | 20 | 2.00 | 27 | 2.33 | 15 | 2.47 |
| 10 | 20 | 2.10 | 27 | 2.52 | 10 | 2.90 |
| 11 | 20 | 2.05 | 27 | 2.15 | 10 | 2.80 |
| 12 | 20 | 2.15 | 36 | 2.22 | 12 | 2.83 |
| 13 | 20 | 2.15 | 36 | 2.25 | 11 | 2.45 |
| 14 | 20 | 2.30 | 45 | 2.38 | 11 | 2.90 |
| 15 | 20 | 2.30 | 45 | 2.56 | 12 | 2.17 |
| 16 | 20 | 2.10 | 50 | 2.30 | 7 | 2.43 |
| 17 | 20 | 2.00 | 45 | 2.24 | 10 | 2.00 |
| 18 | 20 | 2.10 | 45 | 2.29 | 10 | 3.40 |
| 19 | 20 | 1.90 | 36 | 2.08 | 12 | 2.50 |
| 20 | 10 | 2.20 | 27 | 1.85 | 4 | 2.00 |
| 21 | 20 | 1.75 | 27 | 1.63 | 8 | 2.63 |
| 22 | 20 | 1.80 | 18 | 2.17 | 23 | 2.83 |
| 23 | 20 | 2.35 | 18 | 2.22 | 21 | 2.85 |
| 24 | 20 | 2.40 | 18 | 2.44 | 15 | 3.53 |
| 25 | 20 | 2.55 | 18 | 2.39 | 21 | 31.9 |
| 26 | 20 | 2.07 | 18 | 2.11 | 19 | 1.95 |
| 27 | 20 | 1.75 | 27 | 2.37 | 29 | 2.17 |
| 28 | 15 | 2.40 | - | - | 18 | 2.44 |
| 29 | 15 | 2.07 | - | - | 16 | 2.25 |
| 30 | 20 | 2.20 | 12 | 2.25 | 13 | 3.00 |
| 31 | 15 | 2.00 | 10 | 2.10 | 18 | 2.50 |
| 32 | 15 | 2.07 | 13 | 2.23 | 4 | 2.75 |
| 33 | 15 | 2.67 | 16 | 2.62 | 15 | 3.20 |
| 34 | 15 | 2.60 | 15 | 2.06 | 16 | 2.88 |
| 35 | 10 | 1.90 | 15 | 2.33 | 11 | 2.82 |
| 36 | 25 | 2.20 | 18 | 2.17 | 12 | 2.92 |
| 37 | 20 | 2.30 | 18 | 2.33 | 12 | 4.17 |
| 38 | 20 | 2.20 | 18 | 1.94 | 20 | 2.45 |
| 39 | 25 | 2.55 | 18 | 2.11 | 14 | 2.50 |
| 40 | 15 | 2.20 | 18 | 2.28 | 17 | 2.94 |

TABLE V (continued)

| Subject | Indoor Test | | Outdoor Test | | Game Play Test | |
|---|---|---|---|---|---|---|
| | Holes played | Indoor ratio | Holes played | Outdoor ratio | Holes played | Game play ratio |
| 41 | 10 | 2.00 | 18 | 2.39 | 11 | 2.55 |
| 42 | - | - | 18 | 2.50 | 16 | 3.13 |
| 43 | 20 | 2.10 | 18 | 2.67 | 15 | 2.60 |
| 44 | 20 | 2.75 | 21 | 2.48 | 14 | 2.50 |
| 45 | 25 | 2.16 | 21 | 2.05 | 9 | 2.89 |
| 46 | 20 | 1.95 | 18 | 2.50 | 18 | 2.67 |
| 47 | 20 | 2.25 | 32 | 2.38 | 13 | 2.69 |
| 48 | 20 | 1.90 | 27 | 2.22 | 15 | 2.20 |
| 49 | 20 | 2.10 | 27 | 2.19 | 17 | 2.35 |
| 50 | 20 | 2.10 | 31 | 2.41 | 14 | 1.93 |
| 51 | 20 | 1.75 | 30 | 2.03 | 16 | 2.19 |
| 52 | 20 | 2.15 | 27 | 2.11 | 18 | 2.61 |
| 53 | 20 | 2.00 | 32 | 2.22 | 17 | 2.41 |
| 54 | 20 | 2.15 | 28 | 1.89 | 18 | 2.50 |
| 55 | 20 | 1.95 | 45 | 2.00 | 11 | 2.09 |
| 56 | 20 | 2.24 | 46 | 2.22 | 15 | 2.33 |
| 57 | 30 | 2.00 | 42 | 2.10 | 21 | 2.38 |
| 58 | 20 | 2.15 | 36 | 2.08 | 16 | 2.13 |
| 59 | 15 | 2.07 | 36 | 2.14 | 16 | 2.38 |
| 60 | 20 | 2.00 | 9 | 2.33 | 11 | 3.00 |
| 61 | 20 | 1.85 | 18 | 2.22 | 8 | 2.13 |
| 62 | 20 | 1.95 | 18 | 2.06 | 21 | 2.67 |
| 63 | 20 | 2.15 | 18 | 1.95 | 25 | 2.44 |
| 64 | 20 | 2.10 | 18 | 2.22 | 6 | 2.83 |
| 65 | 20 | 2.36 | 18 | 2.22 | 16 | 2.56 |
| 66 | 20 | 2.10 | 18 | 1.89 | 17 | 2.41 |
| 67 | 20 | 2.28 | 18 | 2.50 | 19 | 3.32 |
| 68 | 15 | 2.00 | 18 | 2.44 | 11 | 3.27 |
| 69 | 15 | 2.27 | 18 | 2.33 | 16 | 3.19 |
| 70 | 15 | 2.27 | 18 | 2.50 | 17 | 2.65 |
| 71 | 10 | 1.80 | - | - | 19 | 2.74 |
| 72 | 15 | 2.00 | - | - | 21 | 2.90 |
| 73 | 15 | 2.20 | - | - | 25 | 2.32 |
| 74 | 20 | 2.10 | 18 | 2.17 | 25 | 2.50 |
| 75 | 20 | 2.65 | 18 | 2.33 | 8 | 2.50 |
| 76 | 20 | 2.00 | 18 | 2.50 | 5 | 2.60 |
| 77 | 20 | 2.00 | 18 | 2.50 | 5 | 2.40 |
| 78 | 20 | 2.50 | 18 | 2.61 | 3 | 3.33 |
| 79 | 20 | 1.75 | 18 | 2.22 | 9 | 3.11 |
| 80 | 20 | 2.45 | 18 | 2.28 | 8 | 2.25 |
| 81 | 20 | 2.00 | 36 | 2.00 | 21 | 2.10 |
| 82 | 20 | 2.50 | 18 | 2.33 | 9 | 2.33 |
| 83 | 20 | 1.95 | 18 | 1.72 | 10 | 2.30 |
| 84 | 20 | 2.00 | 18 | 2.33 | 8 | 2.50 |
| 85 | 20 | 2.10 | 18 | 2.22 | 9 | 2.22 |

TABLE V (continued)

| Subject | Indoor Test | | Outdoor Test | | Game Play Test | |
|---|---|---|---|---|---|---|
| | Holes played | Indoor ratio | Holes played | Outdoor ratio | Holes played | Game play ratio |
| 86 | 20 | 2.05 | 18 | 2.17 | 8 | 2.37 |
| 87 | 20 | 2.05 | 18 | 2.28 | 5 | 2.80 |
| 88 | 20 | 2.10 | 18 | 2.39 | 8 | 2.38 |
| 89 | 20 | 2.45 | 18 | 2.22 | 5 | 2.20 |
| 90 | 20 | 2.50 | 18 | 2.67 | 5 | 2.20 |
| 91 | 20 | 1.85 | - | - | 14 | 2.36 |
| 92 | 10 | 2.50 | 27 | 2.19 | - | - |
| 93 | 10 | 2.50 | 27 | 3.00 | 15 | 3.73 |
| 94 | 10 | 2.20 | 27 | 1.93 | 19 | 2.63 |
| 95 | 10 | 2.10 | 27 | 2.41 | 3 | 2.33 |
| 96 | 10 | 2.20 | 27 | 2.41 | 9 | 3.33 |
| 97 | 10 | 2.40 | 27 | 2.59 | 13 | 3.85 |
| 98 | 10 | 2.00 | 27 | 2.48 | 15 | 2.73 |
| 99 | 10 | 2.20 | 27 | 2.04 | 28 | 2.11 |
| 100 | 10 | 2.10 | 27 | 2.33 | 9 | 2.67 |
| 101 | 10 | 2.20 | 27 | 2.33 | 12 | 2.50 |
| 102 | 10 | 2.20 | 27 | 2.44 | 6 | 2.83 |
| 103 | 10 | 1.90 | 27 | 2.11 | 19 | 2.53 |
| 104 | 10 | 2.10 | 27 | 2.56 | 11 | 2.91 |
| 105 | 10 | 2.10 | 27 | 2.41 | 9 | 2.56 |
| 106 | 10 | 1.80 | 27 | 2.19 | 11 | 2.73 |
| 107 | 5 | 2.40 | 9 | 2.22 | - | - |
| 108 | 15 | 2.07 | 9 | 2.11 | 14 | 2.07 |
| 109 | 15 | 2.47 | 27 | 2.26 | 9 | 2.67 |
| 110 | 15 | 1.80 | 27 | 2.44 | 9 | 2.67 |
| 111 | 15 | 1.87 | 27 | 1.89 | 9 | 2.00 |
| 112 | 15 | 1.80 | 27 | 2.07 | 9 | 2.44 |
| 113 | 15 | 1.93 | 27 | 2.30 | 9 | 2.44 |
| 114 | 10 | 1.50 | 27 | 2.41 | 5 | 2.00 |
| 115 | 10 | 2.10 | 27 | 2.30 | 6 | 2.50 |
| 116 | 10 | 2.10 | 27 | 2.04 | 10 | 2.40 |
| 117 | 10 | 2.50 | 27 | 2.00 | 9 | 2.56 |
| 118 | 10 | 2.10 | 27 | 2.07 | 9 | 2.00 |
| 119 | 10 | 1.90 | 27 | 2.26 | 10 | 2.50 |
| 120 | 10 | 2.30 | 27 | 2.30 | 9 | 2.44 |
| 121 | 10 | 1.90 | 27 | 2.04 | 11 | 2.81 |
| 122 | 10 | 2.10 | 18 | 2.06 | 9 | 2.22 |
| 123 | 5 | 2.40 | 18 | 2.11 | 6 | 2.17 |
| 124 | 5 | 3.00 | 18 | 2.39 | 9 | 2.78 |
| 125 | 20 | 2.00 | 9 | 2.22 | 9 | 2.78 |
| 126 | 10 | 2.00 | 18 | 2.11 | 12 | 2.33 |
| 127 | 20 | 2.20 | 18 | 2.20 | 8 | 2.25 |
| 128 | 20 | 2.56 | 18 | 2.83 | 13 | 2.77 |
| 129 | 20 | 1.95 | 18 | 2.44 | 5 | 2.80 |
| 130 | 20 | 2.00 | 18 | 2.28 | 12 | 2.75 |

TABLE V (continued)

| Subject | Indoor Test | | Outdoor Test | | Game Play Test | |
|---|---|---|---|---|---|---|
| | Holes played | Indoor ratio | Holes played | Outdoor ratio | Holes played | Game play ratio |
| 131 | 20 | 2.10 | 18 | 2.39 | 16 | 2.69 |
| 132 | 20 | 2.10 | 18 | 2.06 | 14 | 2.22 |
| 133 | 20 | 2.00 | 18 | 2.28 | 10 | 2.50 |
| 134 | 20 | 2.00 | 18 | 2.44 | 10 | 2.70 |
| 135 | 20 | 2.10 | 18 | 2.22 | 15 | 2.20 |
| 136 | 20 | 2.30 | 18 | 2.61 | 10 | 2.60 |
| 137 | 20 | 1.75 | 18 | 2.56 | 12 | 2.91 |
| 138 | 20 | 1.95 | 18 | 2.00 | 13 | 2.08 |
| 139 | 20 | 2.00 | 18 | 2.17 | 14 | 2.29 |
| 140 | 20 | 2.35 | - | - | 10 | 2.70 |
| 141 | 20 | 2.10 | - | - | 12 | 2.67 |
| 142 | 20 | 2.15 | - | - | 16 | 2.50 |
| 143 | 20 | 1.95 | 63 | 2.38 | 10 | 3.90 |
| 144 | 20 | 1.80 | 63 | 1.95 | 14 | 2.64 |
| 145 | 20 | 1.80 | 63 | 2.08 | 16 | 2.75 |
| 146 | 20 | 1.80 | 63 | 2.00 | 5 | 2.00 |
| 147 | 20 | 2.20 | 63 | 2.19 | 19 | 3.21 |
| 148 | 20 | 1.90 | 36 | 1.61 | 6 | 2.83 |
| 149 | 20 | 2.30 | 63 | 2.33 | 15 | 2.53 |
| 150 | 20 | 2.10 | 63 | 2.24 | 17 | 2.41 |
| 151 | 20 | 2.50 | 63 | 2.46 | 16 | 2.38 |
| 152 | 20 | 2.30 | 63 | 2.29 | 11 | 2.91 |
| 153 | 20 | 2.50 | 63 | 2.65 | 14 | 3.21 |
| 154 | 20 | 2.25 | 63 | 2.40 | 9 | 2.22 |
| 155 | 20 | 2.25 | 63 | 1.97 | 12 | 2.25 |
| 156 | 20 | 1.90 | 63 | 2.10 | 13 | 2.61 |
| 157 | 20 | 2.25 | 63 | 2.43 | 18 | 3.56 |
| 158 | 20 | 2.20 | 63 | 2.19 | 16 | 2.25 |
| 159 | 20 | 2.20 | 63 | 2.46 | 13 | 2.54 |
| 160 | 10 | 2.10 | 36 | 2.19 | 7 | 2.86 |
| 161 | 20 | 1.80 | 18 | 2.06 | 17 | 2.67 |
| 162 | 20 | 2.10 | 27 | 2.52 | 10 | 2.90 |
| 163 | 20 | 2.10 | 45 | 2.29 | 10 | 3.40 |
| 164 | 20 | 1.95 | 45 | 2.00 | 11 | 2.09 |
| 165 | 20 | 1.95 | 63 | 2.38 | 10 | 3.90 |
| 166 | 20 | 2.25 | 63 | 2.40 | 9 | 2.22 |
| 167 | 20 | 2.05 | 36 | 2.11 | 16 | 2.56 |

TABLE VI (continued)

| Subject | Putting Game Play # of holes | Total putts | Ratio | Putting Outdoor Green (Nine holes per trial) 1 | 2 | 3 | 4 | Putting Indoor Green (Four holes per trial) 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 84 | 8 | 20 | 2.50 | 21 | 21 | - | - | 11 | 10 | 9 | 10 |
| 85 | 9 | 20 | 2.22 | 21 | 19 | - | - | 10 | 11 | 10 | 11 |
| 86 | 8 | 19 | 2.37 | 21 | 18 | - | - | 11 | 9 | 11 | 10 |
| 87 | 5 | 14 | 2.80 | 19 | 22 | - | - | 11 | 10 | 9 | 11 |
| 88 | 8 | 19 | 2.38 | 20 | 23 | - | - | 11 | 11 | 11 | 9 |
| 89 | 5 | 11 | 2.20 | 22 | 18 | - | - | 13 | 12 | 12 | 12 |
| 90 | 5 | 11 | 2.20 | 22 | 26 | - | - | 9 | 12 | 10 | 10 |
| 91 | 14 | 33 | 2.36 | - | - | - | - | 11 | 10 | 8 | 8 |
| 92 | - | - | - | 20 | 21 | 18 | - | 14 | 11 | - | - |
| 93 | 15 | 56 | 3.73 | 31 | 23 | 27 | - | 10 | 15 | - | - |
| 94 | 19 | 50 | 2.63 | 18 | 18 | 16 | - | 11 | 11 | - | - |
| 95 | 3 | 7 | 2.33 | 25 | 21 | 19 | - | 10 | 11 | - | - |
| 96 | 9 | 30 | 3.33 | 23 | 23 | 19 | - | 10 | 12 | - | - |
| 97 | 13 | 50 | 3.85 | 28 | 21 | 21 | - | 10 | 14 | - | - |
| 98 | 15 | 41 | 2.73 | 25 | 22 | 20 | - | 9 | 11 | - | - |
| 99 | 28 | 59 | 2.10 | 18 | 21 | 16 | - | 11 | 11 | - | - |
| 100 | 9 | 24 | 2.67 | 21 | 22 | 20 | - | 9 | 12 | - | - |
| 101 | 12 | 30 | 2.50 | 21 | 24 | 18 | - | 11 | 11 | - | - |
| 102 | 6 | 17 | 2.83 | 22 | 21 | 23 | - | 11 | 11 | - | - |
| 103 | 19 | 48 | 2.53 | 20 | 18 | 19 | - | 9 | 10 | - | - |
| 104 | 11 | 32 | 2.91 | 21 | 23 | 25 | - | 9 | 12 | - | - |
| 105 | 9 | 23 | 2.56 | 19 | 24 | 22 | - | 9 | 12 | - | - |
| 106 | 11 | 30 | 2.73 | 18 | 23 | 18 | - | 9 | 9 | - | - |
| 107 | - | - | - | 20 | - | - | - | 12 | - | - | - |
| 108 | 14 | 29 | 2.07 | 19 | - | - | - | 10 | 10 | 11 | - |
| 109 | 9 | 24 | 2.67 | 19 | 21 | 21 | - | 13 | 12 | 12 | - |
| 110 | 9 | 24 | 2.67 | 25 | 21 | 20 | - | 9 | 9 | 9 | - |
| 111 | 9 | 18 | 2.00 | 27 | 51 | - | - | 12 | 7 | 9 | - |
| 112 | 9 | 22 | 2.44 | 21 | 18 | 17 | - | 10 | 8 | 9 | - |
| 113 | 9 | 22 | 2.44 | 19 | 22 | 21 | - | 9 | 11 | 9 | - |
| 114 | 5 | 10 | 2.00 | 22 | 23 | 20 | - | 6 | 9 | - | - |
| 115 | 6 | 15 | 2.50 | 20 | 24 | 18 | - | 11 | 10 | - | - |
| 116 | 10 | 24 | 2.40 | 18 | 18 | 19 | - | 10 | 11 | - | - |
| 117 | 9 | 23 | 2.55 | 20 | 16 | 18 | - | 12 | 13 | - | - |
| 118 | 9 | 18 | 2.00 | 18 | 20 | 18 | - | 12 | 9 | - | - |
| 119 | 10 | 25 | 2.50 | 22 | 19 | 20 | - | 8 | 1 | - | - |
| 120 | 9 | 22 | 2.44 | 22 | 20 | 20 | - | 12 | 11 | - | - |
| 121 | 11 | 31 | 2.82 | 20 | 17 | 18 | - | 9 | 10 | - | - |
| 122 | 9 | 20 | 2.22 | 18 | 19 | - | - | 11 | 10 | - | - |
| 123 | 6 | 13 | 2.17 | 18 | 20 | - | - | 12 | - | - | - |
| 124 | 9 | 25 | 2.78 | 20 | 23 | - | - | 15 | - | - | - |
| 125 | 9 | 25 | 2.78 | 20 | - | - | - | 10 | 11 | 12 | 8 |

TABLE VI (continued)

| Subject | Putting Game Play # of holes | Total putts | Ratio | Putting Outdoor Green (Nine holes per trial) 1 | 2 | 3 | 4 | Putting Indoor Green (Four holes per trial) 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | 11 | 28 | 2.55 | 23 | 20 | - | - | 10 | 10 | - | - |
| 42 | 16 | 50 | 3.13 | 22 | 23 | - | - | - | - | - | - |
| 43 | 15 | 39 | 2.60 | 24 | 6 | 18 | - | 9 | 11 | 12 | 10 |
| 44 | 14 | 35 | 2.50 | 23 | - | - | - | 12 | 14 | 12 | 17 |
| 45 | 9 | 26 | 2.89 | 20 | 18 | - | - | 12 | 13 | 11 | 8 |
| 46 | 18 | 48 | 2.67 | 19 | 26 | - | - | 10 | 9 | 12 | 8 |
| 47 | 13 | 35 | 2.69 | 22 | 23 | 17 | - | 8 | 14 | 12 | 11 |
| 48 | 15 | 33 | 2.20 | 20 | 21 | 19 | - | 9 | 9 | 11 | 9 |
| 49 | 17 | 40 | 2.35 | 20 | 20 | 19 | - | 11 | 11 | 9 | 11 |
| 50 | 14 | 27 | 1.93 | 23 | 22 | 22 | - | 11 | 11 | 8 | 10 |
| 51 | 16 | 35 | 2.19 | 19 | 19 | 18 | - | 10 | 8 | 9 | 8 |
| 52 | 18 | 47 | 2.61 | 18 | 19 | 20 | - | 12 | 10 | 12 | 9 |
| 53 | 17 | 14 | 2.41 | 18 | 23 | 22 | - | 9 | 10 | 11 | 10 |
| 54 | 18 | 45 | 2.50 | 23 | 21 | 18 | - | 13 | 10 | 11 | 9 |
| 55 | 11 | 23 | 2.09 | 18 | 19 | 18 | 18 | 11 | 10 | 9 | 9 |
| 56 | 15 | 35 | 2.33 | 26 | 22 | 19 | 21 | 11 | 11 | 12 | 12 |
| 57 | 21 | 50 | 2.38 | 20 | 19 | 18 | 21 | 13 | 11 | 10 | 12 |
| 58 | 16 | 34 | 2.13 | 19 | 21 | 18 | 17 | 10 | 11 | 11 | 11 |
| 59 | 16 | 38 | 2.38 | 23 | 21 | 16 | 17 | 11 | 11 | 9 | - |
| 60 | 11 | 33 | 3.00 | 21 | - | - | - | 10 | 9 | 10 | 11 |
| 61 | 8 | 17 | 2.13 | 20 | 20 | - | - | 10 | 8 | 10 | 9 |
| 62 | 21 | 56 | 2.67 | 19 | 18 | - | - | 12 | 7 | 11 | 9 |
| 63 | 25 | 61 | 2.44 | 17 | 20 | - | - | 14 | 11 | 11 | 7 |
| 64 | 6 | 17 | 2.83 | 18 | 22 | - | - | 11 | 10 | 9 | 12 |
| 65 | 16 | 41 | 2.56 | 21 | 19 | - | - | 12 | 11 | 13 | 10 |
| 66 | 17 | 41 | 2.41 | 16 | 18 | - | - | 11 | 11 | 10 | 10 |
| 67 | 19 | 63 | 3.32 | 24 | 21 | - | - | 11 | 11 | 10 | 9 |
| 68 | 11 | 36 | 3.27 | 24 | 20 | - | - | 12 | 9 | 9 | - |
| 69 | 16 | 51 | 3.19 | 21 | 21 | - | - | 13 | 9 | 12 | - |
| 70 | 17 | 45 | 2.65 | 19 | 26 | - | - | 13 | 9 | 12 | - |
| 71 | 19 | 52 | 2.74 | - | - | - | - | 10 | 8 | - | - |
| 72 | 21 | 61 | 2.90 | - | - | - | - | 11 | 9 | 10 | - |
| 73 | 25 | 58 | 2.32 | - | - | - | - | 14 | 10 | 9 | - |
| 74 | 25 | 10 | 2.50 | 18 | 21 | - | - | 9 | 9 | 11 | 13 |
| 75 | 8 | 20 | 2.50 | 21 | 21 | - | - | 10 | 11 | 12 | 10 |
| 76 | 5 | 13 | 2.60 | 22 | 23 | - | - | 10 | 9 | 12 | 9 |
| 77 | 5 | 12 | 2.40 | 25 | 20 | - | - | 12 | 9 | 10 | 9 |
| 78 | 3 | 10 | 3.33 | 24 | 23 | - | - | 15 | 12 | 11 | 12 |
| 79 | 9 | 28 | 3.11 | 21 | 19 | - | - | 10 | 8 | 9 | 8 |
| 80 | 8 | 18 | 2.25 | 20 | 21 | - | - | 12 | 13 | 11 | 13 |
| 81 | 10 | 21 | 2.10 | 18 | 18 | - | - | 9 | 11 | 11 | 10 |
| 82 | 9 | 21 | 2.33 | 22 | 21 | - | - | 12 | 9 | 10 | 10 |
| 83 | 10 | 23 | 2.30 | 15 | 16 | - | - | 10 | 10 | 9 | 10 |

TABLE VI

NUMBER OF SUBJECTS, HOLES AND ACTUAL PUTT SCORE RECORDED FOR GAME PLAY, FOUR INDOOR TRIALS AND FOUR OUTDOOR TRIALS

| Subject | Putting Game Play | | | Putting Outdoor Green (Nine holes per trial) | | | | Putting Indoor Green (Four holes per trial) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | # of holes | Total putts | Ratio | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 1 | 11 | 30 | 2.73 | 19 | 16 | 15 | 20 | 12 | 11 | 10 | 9 |
| 2 | 7 | 17 | 2.43 | 20 | 18 | 20 | 19 | 12 | 12 | 10 | 11 |
| 3 | 8 | 20 | 2.50 | 19 | 20 | 20 | 17 | 12 | 11 | 9 | 10 |
| 4 | 16 | 41 | 2.56 | 19 | 20 | 19 | 18 | 10 | 12 | 9 | 10 |
| 5 | 11 | 20 | 1.82 | 21 | 19 | 20 | - | 10 | 9 | 10 | 11 |
| 6 | 10 | 26 | 2.60 | 19 | 24 | 23 | - | 11 | 11 | 8 | 12 |
| 7 | 15 | 36 | 2.40 | 19 | 19 | 21 | - | 11 | 12 | 11 | 9 |
| 8 | 10 | 25 | 2.50 | 21 | 23 | 22 | - | 13 | 13 | 12 | 11 |
| 9 | 15 | 37 | 2.47 | 21 | 22 | 20 | - | 11 | 9 | 11 | 9 |
| 10 | 10 | 29 | 2.90 | 20 | 25 | 23 | - | 10 | 10 | 10 | 12 |
| 11 | 10 | 28 | 2.80 | 20 | 19 | 19 | - | 10 | 11 | 9 | 11 |
| 12 | 12 | 34 | 2.83 | 18 | 20 | 21 | 21 | 11 | 8 | 12 | 12 |
| 13 | 11 | 27 | 2.45 | 20 | 21 | 20 | 20 | 13 | 10 | 11 | 9 |
| 14 | 11 | 32 | 2.90 | 23 | 23 | 19 | 21 | 13 | 10 | 11 | 12 |
| 15 | 12 | 26 | 2.17 | 28 | 21 | 24 | 19 | 13 | 13 | 10 | 10 |
| 16 | 7 | 17 | 2.43 | 18 | 25 | 18 | 19 | 13 | 9 | 10 | 10 |
| 17 | 10 | 20 | 2.00 | 17 | 20 | 21 | 22 | 10 | 9 | 12 | 9 |
| 18 | 10 | 34 | 3.40 | 20 | 23 | 17 | 21 | 10 | 10 | 13 | 9 |
| 19 | 12 | 30 | 2.50 | 20 | 18 | 20 | 17 | 11 | 9 | 10 | 8 |
| 20 | 4 | 8 | 2.00 | 15 | 18 | 17 | - | 13 | 9 | - | - |
| 21 | 8 | 21 | 2.63 | 15 | 14 | 15 | - | 8 | 9 | 8 | 10 |
| 22 | 23 | 54 | 2.83 | 20 | 19 | - | - | 10 | 10 | 7 | 9 |
| 23 | 21 | 60 | 2.86 | 21 | 19 | - | - | 13 | 12 | 11 | 11 |
| 24 | 15 | 53 | 3.53 | 23 | 21 | - | - | 14 | 10 | 12 | 12 |
| 25 | 21 | 67 | 3.19 | 22 | 21 | - | - | 14 | 12 | 12 | 13 |
| 26 | 19 | 37 | 1.95 | 19 | 19 | - | - | 10 | 10 | 11 | - |
| 27 | 29 | 63 | 2.17 | 23 | 21 | 20 | - | 11 | 10 | 8 | 6 |
| 28 | 18 | 44 | 2.44 | - | - | - | - | 13 | 12 | 11 | - |
| 29 | 16 | 36 | 2.25 | - | - | - | - | 10 | 10 | 11 | - |
| 30 | 13 | 39 | 3.00 | 23 | - | - | - | 11 | 11 | 11 | 11 |
| 31 | 18 | 45 | 2.50 | 19 | - | - | - | 9 | 11 | 10 | - |
| 32 | 4 | 11 | 2.75 | 20 | - | - | - | 11 | 11 | 9 | - |
| 33 | 15 | 48 | 3.20 | 25 | - | - | - | 13 | 14 | 13 | - |
| 34 | 16 | 46 | 2.88 | 24 | - | - | - | 12 | 12 | 15 | - |
| 35 | 11 | 31 | 2.82 | 22 | - | - | - | 8 | 11 | - | - |
| 36 | 12 | 35 | 2.92 | 20 | 19 | - | - | 11 | 12 | 10 | 11 |
| 37 | 12 | 50 | 4.17 | 22 | 20 | - | - | 14 | 9 | 11 | 12 |
| 38 | 20 | 49 | 2.45 | 19 | 16 | - | - | 11 | 9 | 12 | 12 |
| 39 | 14 | 35 | 2.50 | 19 | 19 | - | - | 10 | 9 | 11 | 10 |
| 40 | 17 | 50 | 2.94 | 22 | 19 | - | - | 12 | 12 | 9 | - |

TABLE VI (continued)

| Subject | Putting Game Play # of holes | Total putts | Ratio | Putting Outdoor Green (Nine holes per trial) 1 | 2 | 3 | 4 | Putting Indoor Green (Four holes per trial) 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 126 | 12 | 28 | 2.33 | 18 | 20 | - | - | 11 | 8 | - | - |
| 127 | 8 | 18 | 2.25 | 18 | 22 | - | - | 11 | 11 | 12 | 10 |
| 128 | 13 | 36 | 2.77 | 26 | 25 | - | - | 14 | 10 | 11 | 11 |
| 129 | 5 | 14 | 2.80 | 25 | 19 | - | - | 10 | 10 | 11 | 8 |
| 130 | 12 | 33 | 2.75 | 23 | 18 | - | - | 12 | 10 | 10 | 8 |
| 131 | 16 | 43 | 2.69 | 20 | 23 | - | - | 13 | 11 | 9 | 9 |
| 132 | 14 | 31 | 2.22 | 20 | 17 | - | - | 9 | 9 | 13 | 11 |
| 133 | 10 | 25 | 2.50 | 21 | 21 | - | - | 10 | 9 | 12 | 9 |
| 134 | 10 | 27 | 2.70 | 22 | 22 | - | - | 12 | 10 | 9 | 9 |
| 135 | 15 | 33 | 2.20 | 22 | 15 | - | - | 10 | 10 | 11 | 11 |
| 136 | 10 | 26 | 2.60 | 25 | 22 | - | - | 12 | 11 | 12 | 11 |
| 137 | 12 | 35 | 2.92 | 22 | 24 | - | - | 11 | 8 | 8 | 8 |
| 138 | 13 | 27 | 2.08 | 20 | 16 | - | - | 10 | 11 | 10 | 8 |
| 139 | 14 | 32 | 2.29 | 21 | 18 | - | - | 9 | 8 | 13 | 10 |
| 140 | 10 | 27 | 2.70 | - | - | - | - | 13 | 11 | 10 | 13 |
| 141 | 12 | 32 | 2.67 | - | - | - | - | 10 | 13 | 9 | 10 |
| 142 | 15 | 40 | 2.50 | - | - | - | - | 8 | 13 | 9 | 13 |
| 143 | 10 | 39 | 3.90 | 21 | 18 | 17 | 19 | 10 | 10 | 11 | 8 |
| 144 | 14 | 37 | 2.64 | 18 | 17 | 16 | 18 | 11 | 9 | 8 | 8 |
| 145 | 16 | 44 | 2.75 | 18 | 19 | 18 | 19 | 8 | 9 | 10 | 9 |
| 146 | 5 | 10 | 2.00 | 20 | 19 | 17 | 17 | 9 | 8 | 11 | 8 |
| 147 | 19 | 61 | 3.21 | 21 | 20 | 19 | 19 | 11 | 10 | 11 | 12 |
| 148 | 17 | 6 | 2.83 | 15 | 15 | 15 | 14 | 11 | 8 | 9 | 10 |
| 149 | 15 | 38 | 2.53 | 23 | 22 | 18 | 17 | 12 | 14 | 10 | 10 |
| 150 | 17 | 41 | 2.41 | 17 | 21 | 19 | 22 | 11 | 11 | 10 | 10 |
| 151 | 16 | 38 | 2.38 | 22 | 19 | 20 | 20 | 13 | 13 | 14 | 10 |
| 152 | 11 | 32 | 2.90 | 22 | 18 | 18 | 21 | 12 | 11 | 11 | 12 |
| 153 | 14 | 45 | 3.21 | 26 | 24 | 24 | 24 | 12 | 10 | 16 | 12 |
| 154 | 9 | 20 | 2.22 | 24 | 20 | 22 | 21 | 10 | 11 | 13 | 11 |
| 155 | 12 | 27 | 2.25 | 20 | 18 | 17 | 16 | 11 | 12 | 11 | 11 |
| 156 | 13 | 34 | 2.62 | 19 | 19 | 20 | 16 | 9 | 10 | 11 | 8 |
| 157 | 18 | 64 | 3.55 | 23 | 20 | 22 | 22 | 11 | 10 | 11 | 13 |
| 158 | 16 | 36 | 2.25 | 20 | 20 | 21 | 19 | 11 | 9 | 13 | 11 |
| 159 | 13 | 33 | 2.54 | 25 | 22 | 23 | 23 | 10 | 11 | 12 | 11 |
| 160 | 7 | 20 | 2.86 | 21 | 20 | 19 | 19 | 11 | 10 | - | - |
| 161 | 18 | 48 | 2.67 | 17 | 20 | - | - | 10 | 8 | 10 | 8 |
| 162 | 10 | 29 | 2.90 | 20 | 25 | 23 | - | 10 | 10 | 10 | 10 |
| 163 | 10 | 34 | 3.40 | 20 | 23 | 17 | 21 | 10 | 10 | 13 | 9 |
| 164 | 11 | 23 | 2.09 | 18 | 19 | 18 | 18 | 11 | 10 | 9 | 9 |
| 165 | 10 | 39 | 3.90 | 21 | 18 | 17 | 19 | 10 | 10 | 11 | 8 |
| 166 | 9 | 20 | 2.22 | 24 | 22 | 21 | 20 | 10 | 11 | 13 | 11 |
| 167 | 16 | 41 | 2.56 | 19 | 20 | 19 | 18 | 10 | 12 | 9 | 10 |